Aalto University
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Master's Programme in Service Design and Engineering

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Good Practices of the Lean Startup Methodology: Benefits, challenges and recommendations

Master's Thesis
Espoo, July 31, 2016

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Instructor: Håkan Mitts, M.Sc. (Tech.)

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ABSTRACT OF
MASTER'S THESIS

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Most companies strive to capitalize on new business opportunities to innovate and develop new business models. The recent popularity of Lean Startup methodology in the startup scene suggests its potential applicability for the creation of new businesses in a corporate context. Therefore, this thesis identifies how to apply Lean Startup practices in software companies.

The research was conducted as a literature review and a qualitative study, including semi-structured interviews from three Finnish software companies. Furthermore, the study provides a within-case and cross-case analysis of the positive and negative effects and recommendations for applying Lean Startup practices in software companies.

The results indicate that there is resistance to change towards a more innovative company culture, insufficient knowledge and understanding of the Lean Startup, and its practices require time to be learnt. Moreover, the lack of proper communication of the Lean Startup benefits creates rejection from external teams. Nevertheless, the results reveal that the top management commitment to communicate and demonstrate early on what the Lean Startup is can help software companies and customers accept more readily the methodology and shift the company culture mindset towards a more innovative mindset. Furthermore, the results confirm that the Lean Startup application adds customer validation to the product development process, enabling faster product/market fits and data-driven decision-making that improves the process accuracy and speed. Moreover, the innovation accounting practice supports the learning about customer behavior. In contrast, the results show that teams not working together in the same location, customers rigidness and low or high volume of feedback can reduce the product development process speed.

Consequently, software companies should communicate and demonstrate very early on the benefits of the Lean Startup methodology to employees and customers to help them understand, learn and adopt its practices while embracing a more innovative culture.

Keywords: Lean Startup, innovation, entrepreneurship, Build-Measure-Learn, GOOB, MVP, Innovation accounting

Language: English

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In the summer of 2013, I reincorporated to Ixonos as a Service Designer and Project Manager to create and develop a new service innovation approach. At that time, Ixonos was in a turnaround and implementing a new strategy and process. In the autumn of 2013, I suggested the possibility of introducing the Lean Startup ideas to the new approach. Several discussions followed and, in February 2014, we decided to shift the focus to research the potential applicability of Lean Startup ideas in software companies and to include this research as one of the projects that Ixonos would contribute to the Need for Speed joined program funded by TEKES.

All of this would have not been possible without the support of many people, so, here I want to express my gratitude to all of them. First of all, I would like to thank my supervisor, Marjo Kauppinen, and instructor, Håkan Mitts, for being very good listeners and better advisors, and guiding me countless times to the mysteries of thesis writing. Without their encouragement, support, feedback, enthusiasm and involvement this thesis would not exist. I would also like to thank all my Ixonos colleagues, especially Jari Kekkonen, Johanna Nieminen and Niklas Penttinen for listenning to me, endorsing me and supporting me to bring new ideas in the company. I also want to express my gratitude to the Need for Speed researchers, especially the participants of the interviews for their time and commitment even with their tight schedule. Without them the empirical part would not have been possible. Special thanks go to my fellow students and friends Simon, Vittorio and Danielle, whom I have shared wonderful times with and have made my studying time more enjoyable. And finally, to my friends and family for their enthusiastic support and patience with me during all these months. Amongst them, I would like to explicitly thank Claudio for his cheerful support in many aspects of my life, Oscar for giving sound advice and feedback, Karlus and Mireia for their encouragement and always being there and Liisa for loving me and believing in me every day. This thesis is dedicated to all of you, whom I love, respect and admire for being who you are. Thank you!

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Marc Salas Martínez

Contents

List of Tables

List of Figures

Chapter 1

Introduction

1.1 Research Background

Companies struggle to be competitive and survive in a dynamic and continuously changing environment [64]. The heavy competition pushes companies to explore new opportunities for renewal and to develop radically new products and services or business models. However, most companies fail to become ambidextrous because their processes are not well suited for finding nor creating new business opportunities [7, 12, 17, 29].

Since the beginning of the 21st century, a number of methods have been added to the entrepreneurship theory for overcoming the challenges to continuously innovate, including Causation [53], Effectuation [53] and Bricolage [4]. In recent years, the Lean Startup methodology [50] has emerged as a popular new form of entrepreneurship to develop new products and services [8, 10, 12, 29–32, 49, 61, 67]. A few attempts have been made to corroborate the applicability of the Lean Startup methodology in different industries or sectors, including healthcare [34, 57] and manufacturing industries [20] or social [15, 41] and academic sector [5, 38, 60]. However, the greater research attention has focused on the application of the Lean Startup methodology in the IT industry.

Considerable research has been devoted to the application of Lean Startup in software startups. Bosch et al. [9], May [39], Nirwan and Dhewanto [44] and Björk et al. [6] argue that applying the methodology in startups is challenging. Nevertheless, Bosch et al. [9], Björk et al. [6] and Eisenmann et al. [14] discover the conditions and steps required to put it into practise. In contrast, very little progress has been made in the research of Lean Startup practices application in software companies. Kulse [30] and Fagerholm et al. [16] examine the preconditions required for using Lean Startup practices. Alänge [3] explores the organizational characteristics required to conduct continuous innovation. Edison et

al. [13] identify the internal startups characteristics particularly for Lean Startup application.

1.2 Research Problem and research questions

Although some research has been carried out to study the required conditions and organizational characteristics that software companies need to apply the Lean Startup methodology, there is very little empirical evidence on the impact of Lean Startup application within established companies. This indicates that more research is needed, particularly, case studies that focus on the impact of Lean Startup application on software companies.

Therefore, the purpose of this thesis is to identify how to apply Lean Startup practices in software companies. The literature review aims to extract the benefits and challenges of the Lean Startup application. These are collected in an impact table structured in organizational, technical, customer and product development process dimensions, and further divided by specific Lean Startup practices. The empirical part objective is to obtain and collect enough data to analyze the benefits and challenges of the Lean Startup application, particularly in the context of each case company. In addition, the empirical study contrasts the empirical results with the reported in the literature review and presents a set of recommendations for the successful application of Lean Startup practices in software companies.

Consequently, we formulate the following research questions:

1. What are the positive effects of applying Lean Startup practices in software companies?

2. What are the negative effects of applying Lean Startup practices in software companies?

3. What are the recommendations to successfully apply Lean Startup practices in software companies?

Table 1.1 illustrates how the Research Questions relate to the different sections of the thesis.

RQs	Sources	Chapters	Sections
RQ1	*Literature review*	3, 5	3.3.1.1, 3.3.2.1, 3.3.3.1, 3.3.4.1, 3.4, 5.1
	Empirical study	4	4.1.1, 4.2.1, 4.3.1, 4.4.1, 5.1
RQ2	*Literature review*	3, 5	3.3.1.2, 3.3.2.2, 3.3.3.2, 3.3.4.2, 3.4, 5.2
	Empirical study	4	4.1.2, 4.2.2, 4.3.2, 4.4.2, 5.2
RQ3	*Literature review*	5	5.3
	Empirical study	4	4.1.3, 4.2.3, 4.3.3, 4.4.3, 5.3

Table 1.1: Sections of the study related to the Research questions

1.3 Scope of the Thesis

The scope of the thesis is limited to the analysis of the Lean Startup practices required to search and validate a business opportunity within a software company and the effect they have on the company after being applied. Thus, the practices to scale and grow the identified and validated opportunity into a company are left out. Additionally, this study does not focus on the application effects of the Lean Startup methodology on external startups, rather, only studies the effects on internal startups or other innovative initiatives inside the software company. Furthermore, the emphasis of the study is put into the development of the business opportunity and avoids the implications it has on the software development activities.

1.4 Structure of the Thesis

The remainder of this thesis is divided into 6 chapters. Chapter 2 describes the research methods selected to conduct the empirical study. Chapter 3 explores the literature relevant for this study. This includes an overview of the Lean Startup methodology and the practices it consists of. Additionally, the chapter includes the benefits and challenges each selected practice has on software companies. Chapter 4 describes the research findings of the study. Chapter 5 provides the answers to the research questions and discusses the validity of the results. Finally, Chapter 6 draws the conclusions and gives suggestions for future research.

Chapter 2

Research Method

This chapter describes the research methods used in the theoretical and empirical part of this study and is divided in two sections. The first section 2.1 reviews the purpose for the theoretical research, details clearly each stage of the search execution and defines the criteria followed for selecting previous studies. The second section 2.2 reports the chosen empirical research method and the execution process followed to obtain the empirical results.

2.1 Literature Review Research

2.1.1 Purpose

The purpose of the literature review is to identify, analyze and synthesize available relevant research to a particular research question or topic [28]. Therefore, the literature review method was chosen to provide background that supports the understanding of the Research Problem and Research Questions. In addition, the method was used to find and analyze previous work related to the application of Lean Startup practices in software companies. Accordingly, the synthesis of the previous work was concluded in a collection of benefits, challenges and recommendations that partly answers the RQs and sets the foundation for the evaluation and discussion of the empirical results.

2.1.2 Search Process

The research process was an iterative process divided into five phases (shown in Figure 2.1).

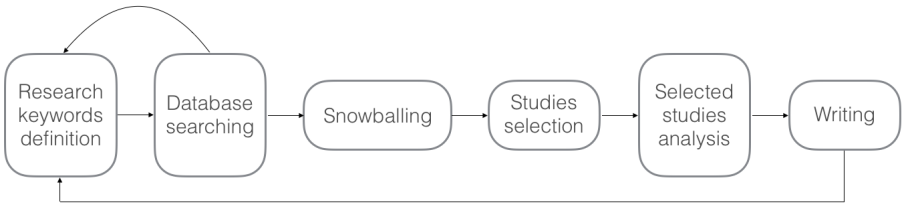

Figure 2.1: Literature review search process

1. **Research keywords definition**
   The definition of the research keywords consisted of extracting key concepts from the research topic and research questions. Therefore, the following concepts were considered:

   - lean startup
   - software companies
   - challenges
   - benefits
   - recommendations
   - innovation process
   - entrepreneurship
   - experimentation

   From the list above, "challenges", "benefits" and "recommendations" concepts were left out for analysis and the latter three were searched to help understand the background and context of the topic. Thus, only "lean startup" and "software companies" were chosen as the initial search keywords.

2. **Database searching**
   The database searching consisted of selecting the databases, construct the search strings and iterate when needed. The selected databases were *IEEE Xplore, ACM Digital Library, SpringerLink, ScienceDirect Elsevier, Wiley interscience, Web of science and Scopus*. The construction of the search string required five iterations. The first iteration search string included

one keyword to gauge the number of resulting hits given the novelty of the methodology. The second iteration included quotation marks to avoid results that included either studies related to the lean methodology (not Lean Startup methodology) or studies related to startups. The third iteration added the concept of "software" to get fewer hits and scope out irrelevant industries. The fourth iteration added "tech" to expand to possible relevant studies. The last iteration added the "lean start-up" keyword to ensure that potentially missing studies have not been left out.

Iterations:

(a) lean startup

(b) "lean startup"

(c) "lean startup" and software

(d) ("lean startup" and software) or ("lean startup" and tech*)

(e) ((("lean startup" OR "lean start-up") AND software) OR (("lean startup" OR "lean start-up") AND tech*))

3. **Snowballing**
   Snowballing is another research technique that can be used to expand the research [65]. Forward snowballing proved to be useful since most selected studies included the book of "THE LEAN STARTUP: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses" [50] as a reference. On the other hand, backward snowballing proved useless for the exact same reason.

4. **Studies selection**
   The selection of relevant studies was done following a selection and quality criteria explained in sections 2.1.3 and 2.1.4 respectively.

5. **Selected studies analysis**
   The analysis of the selected studies was tedious due to the different aspects the Lean Startup methodology covers and the amount of practices it has. Therefore, three main analysis activities were performed. The first activity was to code the studies. Secondly, each coded data was extracted to a concept matrix. Finally, a conceptual model was built for identifying and classifying the benefits, challenges and recommendations of the Lean Startup application.

2.1.3 Inclusion and Exclusion Criteria

The results of the search were filtered by using an inclusion and exclusion criteria to limit the literature review to sources that were relevant in the context of the research problem and the defined scope of the thesis. The potentially relevant studies were mostly included or excluded based on full paper content analysis, except on a few cases where the inclusion or exclusion was based on titles or abstracts.

Therefore, the following inclusion criteria was used to select studies that:

- addressed any Lean Startup practice
- referred to internal startups or other corporate entrepreneurship activities
- belonged to the software development industry

Similarly, this exclusion criteria was used to select studies that:

- only referred to Lean Startup practices to grow or scale a business
- focused on startups rather than companies
- discussed technical software development related activities

2.1.4 Quality Criteria

The quality criteria purpose is to evaluate the quality of the study and determine whether it provides sufficient scientific contribution [58]. The literature review included journal articles, conference proceedings and MSc theses. In contrast, the following quality criteria was used to exclude studies that:

- were corporate white papers
- did not contain references
- compilations that summarized the studies

However, a few exceptions were made. Due to the nature of this thesis, a few non-scientific publications, mainly modern entrepreneurship books, were reviewed and included in the selected sources to complement the literature review. In addition, an interview with the author of the Lean Startup methodology was included.

2.2 Empirical Research

2.2.1 Purpose

The purpose of the empirical study is to answer the research problem and questions of this study. Although the Chapter 3 partly answers these research questions, the empirical study provides deeper understanding and other points of view from the practical application of Lean Startup practices in software companies.

2.2.2 Empirical research method

Various empirical research methods were considered to address the research questions. Quantitative research methods were discarded because the focus was not to quantify the target phenomenon. Thus, we considered qualitative research methods that focus on understanding different phenomena, are characterized by ecological validity (data collected in real environment) and provide flexible research process and emphasis on the target's point of view [37]. While alternative qualitative research methods, such as Design Science or Action Research, could be applied, we chose the case study research method because it aligned very well with the empirical study purpose. The RQs were such that required a good understanding from the companies that applied Lean Startup. Therefore, we wanted to analyze the companies experiences, opinions and knowledge regarding the Lean Startup application and their point of view in the matter. Particularly, case study research method was a suitable approach because it focuses on broad, complex and contemporary phenomena that cannot be studied outside the context in which they occur [66]. Furthermore, we chose to perform multiple case studies to help understand the influence of variability of context and enable within-case and cross-case analysis to gain more general research results [11].

In regards to the research technique, the interview method was the preferred choice for gathering data due to its strength in efficiently gaining deep understanding. An in-depth semi-structured interview is designed around themes, its questions are used flexibly and extra questions can be used for deeper understanding [23]. This allowed the extraction of information from the interviewees experiences that might prove valuable for other companies and researchers. Furthermore, the research method's lack of interventionism, allowed interviewees to analyze their product development process retrospectively, stimulating the interviewee's reflection and allowing them to explain their experience from their own perspective.

Consequently, the chosen research method was multiple case study including within-case and cross-case analysis, using open-ended and in-depth semi-structured individual interviews to collect the data. Therefore, the use of multiple case studies

helped to understand the Lean Startup methodology applicability in a corporate context (software companies).

2.2.3 Empirical research process

The empirical research process was a five-stage iterative process. (shown in Figure 2.2).

Figure 2.2: Empirical research process

1. **Interview template**
   The first stage consisted of the elaboration of the interview template. (See the interview template in Appendix A). An open-ended and semi-structured individual interview was chosen to conduct the research [55]. As such, the identification of themes and initial questions were prepared in advance.

   The purpose of the interview was to unearth the benefits, challenges and recommendations from the practice of Lean Startup methodology in the selected software companies. The interview template was constructed based on the discovered themes in the literature review research method section 2.1.

   In addition, the following considerations were made to ensure the quality of the interview results:

   - An introductory section was added to inform the interviewee of the purpose of the interview, to ensure his/her confidentiality, to ask for audio recording permission and to describe the interview structure [55].
   - The interview structure started with background questions to start with easy to answer questions and to create a pleasant atmosphere for the interview. The next set of questions were high level questions to get a general picture of the topic, help the interviewee refresh the topic and feel more comfortable to get into detail later. In addition, these questions would allow us to get a general understanding of the interviewee's point of view and what words he/she would be using. The interview template gradually led to more detailed questions to gain deeper understanding of the interviewees experience. The interview template concluded with summary questions and an explanation of how the results would be used. [43]

- The questions were open-ended questions, simple, with a neutral and concrete tone and written in the past tense.
- The questions were grouped by themes in a coherent order from the interviewee's perspective. The group of questions started with easy questions and were formulated in a flexible manner to allow skipping them in case of running out of time [43].
- The themes were used as a guide for the interviewer [55]. However, the questions avoided using Lean Startup methodology concepts whenever possible to ensure that the interviewee explained his/her experience in his/her own words.

2. **Sampling**
   The empirical research target population was the set of established software companies that have applied Lean Startup practices. However, it was not feasible to study the whole target group. Alternatively, we defined a sampling population with similar characteristics in the research location (Finland, Helsinki) that would represent the whole group. In this case, the approach followed was to identify Finnish software established companies that were searching for new business and market opportunities, and, from those, select the companies that recognised applying Lean Startup practices.

   Need for Speed (N4S) is a four-year research program designed and overseen by DIGILE and funded by Tekes (the Finnish Funding Agency for Innovation). The program is executed by a consortia consisting of Finnish software companies (11 large industrial organisations, 15 SMEs) and 10 research institutes and universities. The program started in January 2014 and aims to "create the foundation for the Finnish software intensive businesses in the new digital economy." by researching three critical areas to ensure that the Finnish industrial organizations and society can build a successful growth strategy for an unpredictable future. In particular, these three research areas revolve around the development of capabilities to deliver value in real-time, for gaining and applying the deep customer insight and for using the previous targets to exploit new businesses and markets via a continuous and active strategy and new leadership style. [1]

   The N4S research program had potential companies that would match the characteristics of our sampling population. Thus, we extracted a sample of three Finnish software companies that have applied Lean Startup practices.

   The sampling was rather difficult because there were not many companies satisfying the characteristics required.

3. **Empirical data collection**
   The data collection consisted of three interviews conducted with representatives of each software company. We reached each company representative via email and requested the appointment for the interview, negotiated the duration of the interview and agreed on the format of the interview whenever possible.

   The first interview was conducted with the Company A via Internet using a video-conference tool. The available time for this interview was 1 hour and the interview was not recorded. Hence, we took notes during the interview. The available time for the interview proved insufficient to cover extensively the chosen themes for the interview. Therefore, we adapted the discussion by evading detailed questions whenever they did not feel relevant to ask. Taking notes during the interview and not recording the interviewee was a mistake. Taking notes detracted the attention from the interview missing interesting details that would have been collected if recorded. The two-way remote communication medium used for the interview resulted in a less comfortable atmosphere.

   After the first interview, the following corrections were made to the interview template as well as to the format of the succeeding interviews:

   - The interview format would be face-to-face for a better rapport with the interviewee.
   - Extra questions would be asked to clarify and add understanding.
   - The schedule would be extended to give the interviewee time to answer.
   - A recording device would be used to record the interview.

   The conduction and collection of data from the following interviews was much smoother and provided greater level of details.

4. **Empirical data analysis**
   The process to analyse the data started with the transcription of the voice recorded interviews into text, with the exception of Company A, where the notes were taken during the interview. Subsequently, the texts were structured for aiding readability and interpretation.

   The chosen analysis strategy was to conduct within-case and cross-case analysis. The benefits of within-case analysis is that it gives a rich familiarity within each case. In contrast, cross-analysis compares and combines the results of multiple cases [11]. Thus, the content analysis of the text was, first, done individually (within-case). The individual content analysis was done in

three levels of categorization. First, the identification of challenges, benefits or recommendations was coded to the texts. Second, the coded content was categorized according to its relation with a particular Lean Startup practice or defaulted to a generic category of Lean Startup methodology to refer to the whole methodology. Finally, each category was subcategorized following the different impact levels defined as themes in the literature review (organizational, technical, customer and product development process). After each company was analysed individually the process continued with the cross-case comparison.

5. **Empirical results reporting**
   The reporting of the results was structured in tables that illustrate the content analysis explained earlier and provide all the gained results that answered the research questions of the study.

Chapter 3

Literature Review

This chapter examines the literature surrounding the Lean Startup methodology and presents its practices and the impact they have on its application to software companies. Section 3.1 explores the potential innovation initiatives in a corporate environment, defines startup and its stages of development are discussed to contextualize and justify the need for such methodology. Next, it defines a software company. Section 3.2 provides an overview of the Lean Startup methodology and reviews the company requisites for its application. Subsequently, in section 3.3, the chapter examines a selected set of practices and enumerate its benefits and challenges. Finally, section 3.4 outlines an impact table that summarizes and combines the benefits and challenges applying the Lean Startup methodology on different aspects of a software company.

3.1 Corporate entrepreneurship

Companies are such entities that exist because they run businesses based on business models. However, in order to prolong their existence, companies must create new businesses and become ambidextrous [17] [3] [27]. Organizational ambidexterity is the ability to perform, both, exploitation and exploration activities at the same time. Thus, it is deemed as a competitive advantage [64] [27]. However, pursuing organizational ambidexterity (balancing both, exploration and exploitation activities) has been recognised extremely challenging endeavour [17] [3] [64]. In the literature, exploration activities are defined as "technological innovation activities aimed at entering new product-market domains" [64]. Continuous innovation is "the ability to renew the organization and to develop new products and business models" [3]. Corporate Entrepreneurship enables continuous innovation to explore new products and services and new business domains [13]. Therefore, corporate entrepreneurship enables exploration activities to either renew the company or to

create new businesses.

Particularly, there are two types of exploration activities, company renewal activities for existing businesses and innovation activities for the creation of new businesses [13]. Company renewal activities are such that attempt to transform, extend or reconfigure existing businesses with the purpose of creating new business domains [24] [13]. In contrast, innovation activities to create new businesses inside a company can be divided in two clear strategies. The innovation activities can be dispersed to existing divisions or centralized into a single and separate division called Internal Corporate Venture (also known as internal startup) [17] [33] [13] [12]. The creation of new businesses is not limited to companies. Ries defines a startup as "a human institution designed to create new products and services under conditions of extreme uncertainty" [50]. However, a startup can be differentiated between an internal startup or external startup, highlighting its presence inside or outside a company [33].

In the literature, startups are usually understood as external startups. However, Ries, uses a more inclusive definition of a startup to support his claim that the Lean Startup methodology can be applied in any sector, industry or company size [50]. The context in which businesses are created is that of an extreme uncertainty [50] [17]. However, the level of uncertainty can be different depending on the type of startup or the stage they are in. Internal startups operate in a theoretically less risky context because internal startups might get resource support from the parent company [33]. The difference on the level of uncertainty a startup faces depends on the stage of the startup. In the early stage, a startup should focus on exploration activities "innovating with a culture of risk taking, speed, flexibility and experimentation" [64]. At a later stage, the uncertainty is around exploitation activities [64]. Experimentation is seen as a valid approach to reduce the uncertainty risk surrounding the creation of businesses [17] [48] [27].

3.1.1 Stages of a startup

Customer Development is a four-step process invented by Steve Blank. In the book "The Four Steps to the Epiphany: Successful Strategies for Products that Win" [7], Blank describes these four steps as Customer Discovery, Customer Validation, Customer Creation and Company Building. These four steps can be understood as the 4 stages a startup needs to go through in order to become an established company, depicted in figure 3.1.

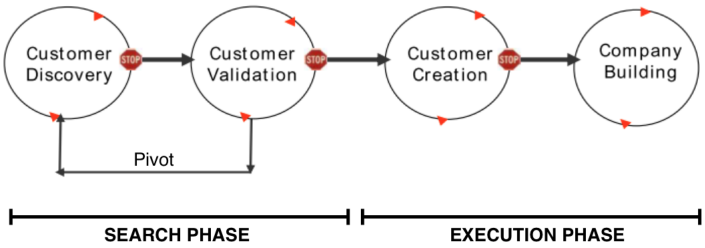

Figure 3.1: 4 stages of a startup development [7]

Blank [7] defines the Customer Development in two phases: the Search Phase and the Execution Phase. In the first one (the search phase) a startup searches for a business model that could work, as well as, products and services that might sell [7]. Once the business model is proven, the second phase starts, in which the startup executes the model and starts building a formal organization [7, 8].

In the Search Phase, startups must do Customer Discovery and Customer Validation. The first step, Customer Discovery, focuses on understanding customer problems and needs. While the second step, Customer Validation, focuses on developing a sales model that can be replicated. The sales model is validated by running experiments to test if customers value how the startup's products and services are responding to the customer problems and needs identified during the previous step. If customers show no interest, then the startup can pivot to search for a better business model. [7, 8]

In the next phase, the Execution Phase, startups must start building end user demand (Customer Creation) to begin scaling the business. In addition, startups must begin the transition from the temporary organization designed to search a business model to a structure focused on executing a validated model (Company Building). [7, 8]

Blank believes that product-market fit needs to happen before moving from Customer Validation to Customer Creation, or, similarly, from the Search Phase to the Execution Phase [7].

3.1.1.1 Searching for Fit

Product-market fit, a term coined by Marc Andreesen, describes "the moment when a startup finally finds a widespread set of customers that resonate with its product" [50]. Alex Osterwalder et al. define searching for Fit as the "process of designing value propositions around products and services that meet jobs, pains and gains that customers really care about"[47]. In fact, this process happens in three stages called Problem-Solution Fit, Product-Market Fit and Business Model

Fit.

The Problem-Solution Fit occurs when entrepreneurs identify relevant insights that can be addressed with a suggested solution. As Osterwalder et al. describe it, this fit happens when there is "evidence that customers care about certain jobs, pains and gains, and, there is a value proposition designed that addresses those jobs, pains and gains" [47]. The next fit, Product-Market Fit, happens when "customers react positively to the value proposition and it gets traction in the market" [47]. Therefore, there is evidence that customers care about the products and services that conform the value proposition. Similarly, Nobel [45] defines product marketing fit as the acknowledgement of having found a solution matching the problem. In this case, she notes that the fit is "recognized in retrospect" rather than in a particular moment [45]. The last fit, Business Model Fit, "takes place when there is evidence that the value proposition can be embedded in a profitable and scalable business model" [47].

These three stages to search for fit match perfectly with the steps defined by Steve Blank. The Product-Solution Fit stage is achieved when startups have done Customer Discovery. In Customer Discovery the startup aims at understanding customer problems and needs and, also, to ideate potential solutions that could be valuable based on the findings. Similarly, Osterwalder et al. [47] call these problems and needs as jobs, pains and gains. Consequently, the next step, Customer Validation, needs to happen to validate if the customers really care about the products and services that could be valuable to them. Therefore, Product-Market Fit, occurs when there is a sales model that works, when customers think the proposed solution is valuable to them. Finally, the Customer Creation step, to "start building end user demand to scale the business" [8], is the precursor to achieve Business Model Fit. Therefore, the Business Model Fit stage can be understood as validating the value for the company, where as the product-market fit focuses on validating the value for the customer.

An important consideration is that the product/market fit cannot happen unless the problem/solution fit has been achieved first. An attempt to achieve product/market fit directly implies the neglect of a necessary learning process that needs to happen to realize what is the problem that needs to be solved [18]. Figure 3.2 illustrates the integration of the Customer Development model with the corresponding fits achieved after each startup stage.

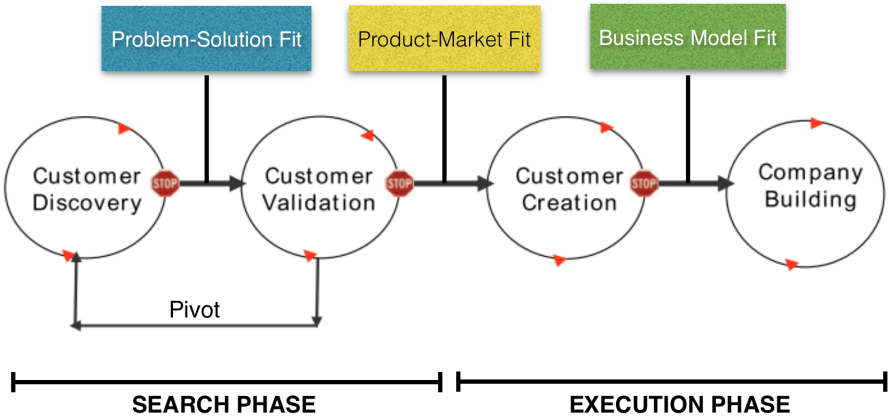

Figure 3.2: 4 stages of a startup development with corresponding fits

3.1.2 The goal of a startup

The vision of a startup is what a startup would like to achieve or accomplish in the mid-term or long-term future. To achieve that vision, startups employ strategy, and, the end result of this strategy is materialized as a product [50]. A startup is considered to be successful when it has achieved Product-Market Fit and is able to prolong this success in a sustainable manner (to a Business Model Fit). Therefore, when we say that a startup is successful, it is because it has been able to build a sustainable business around a vision. A startup should use a process of optimization to change the product to achieve Product-Market Fit and the process of steering - learning whether to pivot or persevere- to make strategic changes to achieve the desired vision. It is well-known that startups face the challenge of quickly running out of resources. Therefore, it is imperative that we include the need for speed in the process of building a startup. The goal of a startup is to learn -as quickly as possible- how to build a sustainable business while realizing the desired vision [50]. Startups can use scientific experimentation to learn if they are making progress towards the startup goal by building products as experiments using the outcome of these experiments as the learning about how to build a sustainable business [50].

3.1.3 What is a software company?

This thesis uses the term “software company” to refer to established companies that operate in the IT industry. An established company is to be understood as the opposite of a startup. Therefore, an established company already operates an

existing business in the IT industry. The literature refers to companies as "firms", "organizations", "enterprises" or "corporations". The distinction of each term is left out of scope from this thesis and is not considered to be relevant. Similarly, the company size (SME or large company) is not significant in this study. The more accurate term would be to express "established software company". However, for the purpose of this thesis "software company" term is used instead.

In this thesis we consider three types of software companies: B2C, B2B and consulting software companies. First, B2C software companies develop their own products or services and their end-customers are consumers. Alternatively, B2B software companies develop their own products and services but their end-customers are other companies not necessarily in the IT industry. Finally, consulting software companies are subcontracted to develop their clients' products and services.

3.2 Overview of the Lean Startup methodology

This section presents an overview of the Lean Startup methodology and reviews its principles, origins and definition. In addition, two sets of Lean Startup practices (steering and acceleration practices) are introduced. Finally, the section discusses the organization characteristics required to apply the Lean Startup in a software company.

3.2.1 The Lean Startup principles

To fully understand the Lean Startup methodology, first we must explore its five principles the methodology is based on:

Principle 1: "**Entrepreneurs are everywhere.** You don't have to work in a garage to be in a startup. The concept of entrepreneurship includes anyone who works within my definition of a startup: a human institution designed to create new products and services under conditions of extreme uncertainty. That means entrepreneurs are everywhere and the Lean Startup approach can work in any size company, even a very large enterprise, in any sector or industry." [50]

Principle 2: "**Entrepreneurship is management.** A startup is an institution, not just a product, and so it requires a new kind of management specifically geared to its context of extreme uncertainty. In fact, as I will argue later, I believe "entrepreneur" should be considered a will argue later, I believe "entrepreneur" should be considered a job title in all modern companies that depend on innovation for their future growth." [50]

Principle 3: "**Validated learning.** Startups exist not just to make stuff, make money, or even serve customers. They exist to *learn* how to build a sustainable

business. This learning can be validated scientifically by running frequent experiments that allow entrepreneurs to test each element of their vision." [50]

Principle 4: "**Build-Measure-Learn.** The fundamental activity of a startup is to turn ideas into products, measure how customers respond, and then learn whether to pivot or persevere. All successful startup processes should be geared to accelerate that feedback loop." [50]

Principle 5: "**Innovation accounting.** To improve entrepreneurial outcomes and hold innovators accountable, we need to focus on the boring stuff: how to measure progress, how to set up milestones, and how to prioritize work. This requires a new kind of accounting designed for startups—and the people who hold them accountable." [50]

3.2.2 The Lean Startup origins

The author of the Lean Startup methodology, Eric Ries, explains in his book "The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses" [50], that traditional management practices and ideas are not adequate to tackle the entrepreneurial challenges of startups. By exploring and studying new and existing approaches, Ries [50] found that adapting Lean thinking to the context of entrepreneurship would allow to discern between value-creating activities versus waste. Thus, Ries, decided to apply lean thinking to the process of innovation [50]. After its initial development and some refinement, the "Lean Startup represents a new approach to creating continuous innovation that builds on many previous management and product development ideas, including lean manufacturing, design thinking, customer development, and agile development" [50].

3.2.3 The Lean Startup definition

The Lean Startup methodology is described in Eric Ries's publication as a method. He also refers to it as a framework, a model, a methodology, an approach, a set of practices and a set of techniques. However, he advises to not think of it as a set of tactics or steps. The author also uses the term method to refer to a practice indistinctively. For the purpose of this thesis clarity, we will use methodology, principles and practices (instead of methods). Therefore, we define the Lean Startup methodology as "a set of practices for helping entrepreneurs increase their odds of building a successful startup" [50]. Firstly, by teaching entrepreneurs how to drive a startup through the process of steering (Build-Measure-Learn feedback loop) [50]. Secondly, by enabling entrepreneurs to scale and grow the business with maximum acceleration [50].

3.2.4 The Lean Startup practices

The Lean Startup methodology can be divided in two sets of practices: the steering practices (designed to minimize the total time through the Build-Measure-Learn feedback loop) and the acceleration practices, which allow Lean Startups (startups that use the Build-Measure-Learn feedback loop process) grow without sacrificing the startup's speed and agility [50]. The first set of practices must be in place before using the second set of practices.

3.2.4.1 Steering practices

The steering practices allow entrepreneurs to learn to steer (whether to pivot or persevere) in the most efficient manner [50]. Entrepreneurs can hypothesize which is the right direction and test and measure the progress of the assumptions they made while gaining valuable insights that help them to make more informed decisions [50]. This process is called Build-Measure-Learn feedback loop (See section 3.3.1). Table 3.1 describes the list of the steering practices.

Purpose	**Practice name**	**Description**
Hypothesise	Leap-of-faith assumptions	Riskiest strategical assumptions[50]
	Get out of the building	Talk with potential customers to prove the leap-of-faith assumptions[50]
Test	Minimum Viable Product	Minimum product features built to test hypotheses from real customers[50]
Measure	Innovation accounting	System that quantifies the learning to grow the business[50]
	Actionable metrics	Metrics that show a direct link between the product development actions and the customer behavior[50]
	Cohorts and split-tests	Provide two versions of the product to two similar customer groups at the same time[50]
	Kanban	Prioritization of product development stories[50]
Learn	Validated learning	Learning about hypotheses validated via scientific experimentation[50]
	Pivot (or persevere)	Mechanism to change the course of product development and explore new alternative paths[50]

Table 3.1: Lean Startup methodology: steering practices

3.2.4.2 Acceleration practices

The acceleration practices enable startups to scale and grow fast, adapting the organization structure and culture and developing a discipline of execution to transition to established companies [50]. All that, without compromising the speed, agility and mantaining the innovation capacity of a startup. Table 3.2 describes the acceleration practices from the Lean Startup methodology.

Purpose	**Practice name**	**Description**
Scale	Small batches	Reduction of batch size to speed up the feedback loop[50]
	Continuous deployment	Automatic identification and removal of product defects and re-deployment of fixed parts[50]
	Just-in-time scalability	Stop production to fix a problem which should never stop production again[50]
Grow	Engines of growth	Mechanism to identify the sources of sustainable growth[50]
Adapt	Five Whys	Root cause analysis that prevents future process problems[50]
Innovate	Startup team structure	Self-autonomous and cross-functional teams with secured small capital and independent authority [50]
	Platform for innovation	Protected space of operation with its own rules and without restrictions from the parent company [50].

Table 3.2: Lean Startup methodology: acceleration practices

3.2.4.3 Customer Development and Lean Startup

The Lean Startup's two sets of practices (steering and acceleration) map perfectly with the 4 stages of a startup defined by Steve Blank's Customer Development process, and the 2 phases (search and execution) explained in 3.1.1. The search phase, that includes Customer Discovery and Customer Validation steps, correspond to steering practices. The goal of these 2 stages are to validate that a problem exists that is worth solving and that customers find value in the solution proposed to solve the problem [47]. Thus, the focus is to search for and find a business that could grow and become sustainable. Once the product/market fit

has been reached -the startup has found a solution that provides value to a potential profitable market- it is time to find value for the company [47]. On the other hand, we have the execution phase, including Customer Creation and Company Building, corresponds to acceleration practices. The goal of these 2 stages is to make the business sustainable (profitable and scalable) [47]. Therefore, the Lean Startup acceleration practices are suitable here, as it is about improving execution efficiency and speeding up the learning of how we can find value to the company with the solution that solves the problem to the customers and is wanted by the customers. Figure 3.3 illustrates the integration of the Lean Startup practices with the Customer Development process.

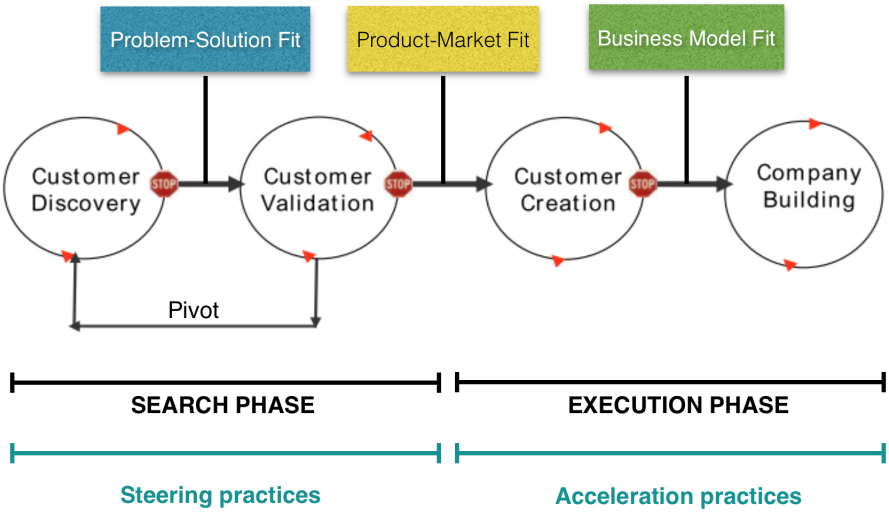

Figure 3.3: Lean Startup practices integrated with Customer Development

As stated in section 1.3, the thesis focuses on the Lean Startup practices needed to find and validate a business opportunity within a software company. Such practices are the steering practices that need to be in place before accelerating the business. Furthermore, since software companies are established companies, the succeeding section includes the suggested Lean Startup practices to innovate in an established company. Following sections discuss the steering practices and its benefits and challenges in more detail.

3.2.5 Lean Startup application requirements in a software company

The Lean Startup usage in a company requires an organization structure, culture and discipline to handle the search for growth while mantaining the operational activities [50]. In addition, applying the methodology on existing processes requires the adopting company to adapt the practices to the current company culture and processes [12, 30]. The Lean Startup defines the team structure to be self-autonomous and full-time cross-functional teams that have secured small capital, the necessary authority for not slowing down learning and accountability by unnecessary approvals and the recognition of the innovation success [50, 51]. In the corporate entrepreneurship literature, the figure of a champion is often revealed. Several recent studies [3], [17], [12] have agreed that the presence of a champion is needed to lead, coach and be the interlocutor between the innovation team and management. In other studies, there has been a distinction between product champion or organizational champion depending on their mentoring or negotiating roles [12, 22, 49]. However, the Lean Startup does not position itself with the need for a champion or not to lead the innovation team, rather, suggests the top management to give full support to create team structures as noted above. In fact, Edison [12] discovers the absence of champion and mentorship in an application of the Lean Startup in an internal corporate venturing study.

When it comes to the organizational structure, Lean Startup advocates for establishing a "platform for innovation" with its own rules that operate within pre-established and agreed boundaries that foster the impact of the startup into the company without constraining its startup methods [50]. Another important requirement is the need to change the company culture. Alänge [3] suggests that top management should instill a more innovative and open to change culture amongst its employees to foster creativity, commitment and passion to innovate in a continuous learning environment. Similarly, the Lean Startup methodology acknowledges the need for a change of mindset of employees and management towards a management philosophy that aims to balance exploration and exploitation activities [50]. Thus, Ries [50] proposes that top management should support innovation teams by allocating full-time employees on teams instead of dividing their time in different projects, use innovation accounting to define bonus and accountability targets and give the employees the freedom to continue with the product or stay behind for a new venture. Instead of requirements, Kulse [30] derives a set of enablers that would help the adoption of Lean Startup methodology by consulting software companies that aim at becoming strategic partners. While having a learning orientation, knowledge of lean and agile practices and strategic position as a key partner would enable a company to succeed, Kulse [30] concludes that customer's role is key to accept the introduction of Lean Startup practices in the

product development process.

3.3 Lean Startup steering practices

This section examines four Lean Startup steering practices in greater detail in relation to its applicability impact on software companies. The selected practices are Build-Measure-Learn feedback loop, Get out of the Building, Minimum Viable Product and Innovation accounting. The selection of these practices is based on the following:

- Build-Measure-Learn feedback loop encompasses the underlying steering practices. Thus, it is important to understand the big picture of this practice.
- This thesis puts emphasizes on the early contact with customers. Thus, Get out of the Building practice is more adequate to represent the steering practices used to hypothesize.
- Minimum Viable product is the only steering practice described in the Lean Startup methodology for testing purposes. Thus, we select it to explain a crucial aspect of the steering practices.
- The innovation accounting practice integrates other practices such as actionable metrics, cohorts and split-tests. In this thesis we consider that the level of detail of innovation accounting is enough to understand the purpose of these steering practices. Thus, we choose this practice to represent the steering practice used for measuring the customer behavior.
- In this thesis we do not include the steering practices to learn such as validated learning and pivot. We understand the learning as the goal of the steering practices. Therefore, we choose to analyze the practice that lead towards the goal (validated learning).

3.3.1 The Build-Measure-Learn feedback loop process

The Build-Measure-Learn feedback loop is the startup steering wheel and the steering practices are the parts that shape it. Entrepreneurs can use the steering wheel to learn how to drive towards the startup's destination (vision), and "when, and if it's time to make a sharp turn called pivot (business strategy change) or whether the startup should persevere along the path" [50].

It is believed that the Build-Measure-Learn feedback loop originates from the Observe-Orient-Decide-Act (OODA) loop created to gain strategical advantage in front of uncertain environments [27, 64].

The Build-Measure-Learn feedback loop is a continuous and iterative process based on scientific experimentation [50]. Each iteration consists of three phases, as shown in the figure 3.4 below.

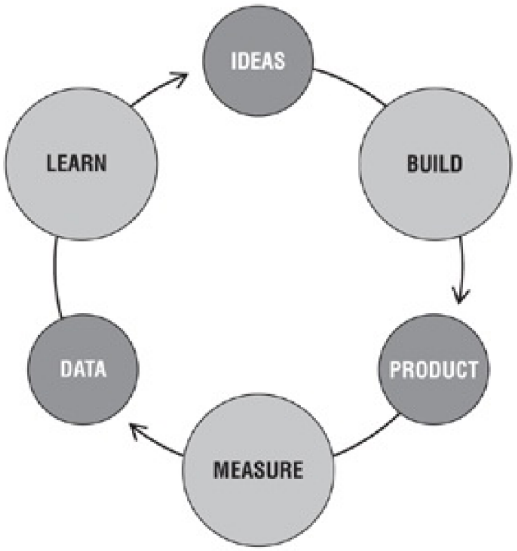

Figure 3.4: Lean Startup Build-Measure-Learn feedback loop process [50]

Build phase In the build phase, entrepreneurs build a product as an experiment to test hypothesis they have about their customers behavior. This experiment is called Minimum Viable Product, and is designed to measure the impact it has on the customers [50].

Measure phase In the measure phase, entrepreneurs measure the customer interaction with the Minimum Viable Product and obtain data in the form of qualitative and quantitative feedback. "Entrepreneurs can determine whether the product development efforts lead to progress using a quantitative practice called innovation accounting" [50].

Learn phase In the Learn phase, entrepreneurs use the data obtained in the previous phase to validate or refute the hypothesis tested with the Minimum Viable Product, and use this learning (now, validated learning), to make a decision to continue with the current business strategy or change it (pivot) and to identify new hypotheses to be tested in the next iteration [50].

While the feedback loop activities happen in the order of the phases described above, the planning of such activities is done in the reverse order. First, en-

trepreneurs must "figure out what needs to be learned. Second, figure out what we need to measure to know if we are gaining validated learning. And last, figure out what product we need to build to run that experiment and get a that measurement" [50].

There seems to be a clear distinction between the first and the succeeding iterations of the Build-Measure-Learn process. The first iteration is characterized by translating the vision into business strategy hypotheses that are later materialized and validated with a first Minimum Viable Product. Such activity does not happen in the consequent iterations. From that point onwards, the focus is on making product improvements to continue validating the drawn strategic hypotheses until there is a clear learning to either continue with or change that strategy [12].

The Lean Startup is a fast-learning-driven approach. The importance of learning and speed is noted extensively in the literature. Kulse [30] has remarked how the ultimate goal of the Build-Measure-Learn feedback loop is to achieve learning. Similarly, Hämäläinen et al. [21] have referred to the process as a "learning process" and have emphasized the importance of speed to make progress. Sauvola et al. [54] have observed that the Lean Startup methodology enables faster product development of the product customers wish through validated learnings. Ries [50] has reported how learning faster is a competitive advantage. That is why he emphasizes that the steering practices are designed to minimize the total time through the Build-Measure-Learn feedback loop.

Finally, the Build-Measure-Learn practice shifts the focus of agile methods in software companies from solution-oriented to customer-oriented focus. Therefore, granting software companies a better ability to evaluate and develop what customers value [46]. This underlines the importance of the customer role in the creation of a new service or product.

The Build-Measure-Learn feedback loop process is a central concept and is considered the core practice of the Lean Startup methodology [46, 50]. In fact, in the literature the Lean Startup methodology term is mostly used to refer to the process.

In this thesis, we acknowledge that this view is incomplete. As stated in section 3.2.4, the Lean Startup methodology consist of steering and acceleration practices. However, the scope of this study concerns only with steering practices applied in software companies. Consequently, in the following subsection we use the Build-Measure-Learn feedback loop process to group the positive and negative effects of Lean Startup application in software companies on a general level. Furthermore, the consecutive sections address the most relevant steering practices together with their specific benefits and challenges.

3.3.1.1 The Build-Measure-Learn process benefits

The Build-Measure-Learn process and the Lean Startup methodology affect positively the customer, the product development process and the software company. Table 3.3 shows the Build-Measure-Learn benefits classified by the aforementioned aspect dimensions.

First, the Lean Startup benefits from the customer point of view are various. The Build-Measure-Learn process puts the customer in a central role, allowing to observe, interact and learn from the customer [50]. The closeness to the customer enables the software company to increase their customer understanding [50]. In addition, it makes it easier to collect direct feedback from customers [21]. In fact, it has several positive consequences. The Lean Startup is able to demonstrate, with quantifiable evidence, due to the customer action or inaction the value adding or value destroying activities [21, 50]. Moreover, the time to experiment and validate these is substantially reduced [13]. Another advantage is that it fosters higher end-user acceptance, and, this acceptance is translated into a growing and established set of customers at the time of launching the product or service to mass market [30, 50]. Finally, as a contractor partner it allows to get closer to the customer business and take advantage of a more strategical position [30].

Second, the most important benefit for the product development process is that it adds validation to the process [30]. Such addition has many positive consequences that derives in added benefits. First, decisions become data-driven [52]. As a result of that, the process gains accuracy and speed [46, 50]. Validation enables the company to focus its resources on building features that increase the product value and have larger impact [13, 52]. And, the fears about quality, product acceptance and brand damage dissipate [50]. On the other hand, the increase in accuracy implies increase in speed. The process mitigates waste saving time and money [50], making the feedback cycle shorter [13, 21, 52] and reaching product/market fit faster [13].

Finally, the software company benefits from structural and cultural changes in it. Structurally, the company that applies Lean Startup is prone to break silos within the company due to the implementation of cross-functional teams [30]. Culturally, the acceptance of learning as a unit of progress triggers a mindset shift towards a more innovative culture [21, 30]. Consequently, the employees become more passionate about their visions, motivation grows and teams become more responsible [13, 21, 30]. Furthermore, the software competency in innovation rises [21].

	Organizational
BML	Mindset shift towards a more innovative culture
	Employee motivation towards innovation
	Increase of team responsibility
	Increase innovation competency
	Break silos with cross-functional teams
	Customer
BML	Increase customer understanding due to customer closeness
	Easier to collect direct feedback from customers
	Demonstration of customer value adding/destroying activities
	Reduction of experimentation time to validate ideas
	Higher end-customer acceptance
	Established customer base on mass market launch
	Being closer to customer business provides strategical advantage as a contractor partner
	Product Development Process
BML	Validation added to the process
	Data-driven decisions improve process accuracy and speed
	Validation directs resources to increase product value and impact
	Fear dissipation about product quality and acceptance and brand damage
	Waste mitigation saves time and money
	Shorter feedback cycle
	Faster product/market fit

Table 3.3: Build-Measure-Learn benefits

3.3.1.2 The Build-Measure-Learn process challenges

The Lean Startup methodology presents a variety of challenges in its application to software company. This section discusses its organizational, process, technical and customer related challenges. Table 3.4 summarizes the Build-Measure-Learn challenges classified by the aforementioned aspect dimensions.

The application of the Lean Startup in already existing processes requires the top management support, commitment and an innovative culture [2, 13, 21, 50]. In the literature there is a sound agreement that the organizational culture should shift towards a more innovative and experimental mindset [13, 30, 52]. However, creating a culture of innovation within the company is not exempted from challenges. Particularly, the resistance to change can come from the top management or from external teams. The top management team can be overprotective towards the company. Edison et al. [13] note that companies do not want to harm their

businesses and markets. In addition, top management can also limit the scope of innovation potential by restricting the innovation to happen within the scope of the corporate strategy [13]. In contrast, the same top management can neglect support to innovation teams. Rissanen and Münch [52] recognize that the competence in experimentation is not very high and education is needed to enhance team capabilities. However, top management prefers to sponsor technology rather than teams [27]. The transition to an experimentation culture affects external teams as well [30]. External teams might offer some resistance to change when the innovation team does not follow the company procedures, as that raises complaints from them [13]. Another organizational challenge in applying Lean Startup arise from the lack of familiarity with Lean Startup practices. On the other hand, having a rigid or strict view of the Lean Startup practices can be detrimental to their adoption [30].

The Build-Measure-Learn has a few challenges as a product development itself. The lack of clarity in defining the hypotheses or the expected results upfront might hinder the ability to learn [36]. In addition, the company bureaucracy can have a negative effect to the process. The communication in companies is slower, and that automatically reduces the development speed [27].

In [52], Rissanen and Münch evaluate the application of a Learn-Build-Measure based practice called continuous experimentation in B2B and discover the following technical challenges. First, the experiments scope gets substantially reduced if the product does not have user interfaces to interact with end-user. i.e. the product is an API [52]. Second, the low volume of end-users reduces the reliability of statistical significance from the experiments [52]. Third, it is challenging to identify measurable metrics that provide value for the customers [52]. Fourth, the experimentation on existing software requires to set up the experimentation infrastructure on top of existing software architecture [52]. Lastly, the analysis of collected data requires to collect, store and transfer the data from customers environments to analysis environments [52].

The customer has an important role in the Lean Startup application. In case of B2B, the company and customer organizational culture determine the variety of challenges a software company faces when applying the methodology. The influence of the customer organizational culture can be so strong that customers become authentic doorkeepers [30]. The customers stiffness is driven by resistance to change the way they operate and by fear. Customers fear that major changes in the product might degrade the user experience, therefore require the changes to be informed and accepted before production release. Thus, product deployments determine the process speed [52]. Another fear customers have is to overpromise to their end-customers [21]. Another challenge is that since requirements by customers bring in revenue, they are prioritized over own product development [52].

There are also limitations regarding the feedback collection. The product end-users might be the customer's customers complicating the feedback collection [52]. On the other hand, the limitation is determined by the customer itself, which requires to legalize how the user behaviour data collection has to be done [52]. Moreover, in B2B, customer uniqueness lowers the value of experiments because they are significant to very few customers with similar qualities [52]. Consequently, the complicity of the customer is required to conduct experimentation process [52].

	Organizational
BML	Resistance to change towards an innovative culture
	Top management overprotection towards the company
	Top management innovation scope limitation to corporate strategy
	Top management lack of support towards the innovation team
	Lack of experimentation skills and Lean Startup practices knowledge
	Raises complaints from external teams for not following company procedures
	Lean Startup understanding rigidness
	Technical
BML	Experimentation scope reduced with lack of user interfaces
	Reduced experiments reliability due to low end-user volume
	Experimentation infrastructure implementation on top of a mature project
	Difficult identification of value-adding measurable metrics
	Customer
BML	Customers can be doorkeepers
	Acceptance-tested software by customers before production release
	Fear of overpromising to end-customers
	Developed features come as requirements from customers
	End-users as customers' customers complicates feedback collection
	Legal agreements for usage data and user feedback collection
	Lead customer pro-activity required to develop the experimentation process
	Product Development Process
BML	Unclear hypotheses and results expectations might hinder the learning ability
	Company bureaucracy slows down the development speed

Table 3.4: Build-Measure-Learn process challenges

3.3.2 Hypothesising practices: Get out of the building

The previous section 3.3.1 introduced a distinction between the first and successive iterations. The Lean Startup methodology indicates that first and foremost, an entrepreneur should translate the business vision into a provisional strategy based on assumptions. From these assumptions, the riskiest assumptions, called leap-of-faith assumptions, should be tested first. Therefore, in the first iteration, an entrepreneur must focus on validating the two most important leap-of-faith assumptions: the value hypothesis and the growth hypothesis."The value hypothesis tests whether a product or service really delivers value to customers once they are using it and the growth hypothesis tests how new customers will discover a product or service" [50].

Prior to moving to the next stage in the process (build and test the hypothesis), the Lean Startup suggests the use of the "Get out of the Building" practice (GOOB) to confirm whether the assumptions are based on reality and if the customer problem is worth solving [50]. Blank uses the term "Get out of the Building" (GOOB) in the Customer Development model to point out that entrepreneurs need to get out of their office and talk with potential customers to collect facts and understand customers problems and needs to be addressed during the Customer Discovery stage [7].

The early contact with customers can be used to design a provisional customer archetype to guide future decision-making and decide which assumptions need more urgent testing [50]. In this thesis, we choose the GOOB practice to represent the hypothesising practice and study more in detail the positive and negative effects of early contact with customers.

3.3.2.1 GOOB benefits

The software company clearly benefits from the early contact with customers. First, the early validation with real customers allow entrepreneurs to realize the right questions to ask or hypotheses to validate [50]. Similarly, it can help identify which original plans are misguided [50]. Finally, initial customer feedback can help improve the product [13].

Table 3.5 summarizes the GOOB benefits.

	Customer
GOOB	Discover misguided plans
	Discern the right questions to ask
	Potential to improve the product

Table 3.5: GOOB benefits

3.3.2.2 GOOB challenges

There are associated challenges in the practice of GOOB. Table 3.6 summarizes the organizational, product development process and customer related challenges.

From the company point of view, there are structural and cultural challenges. Since this practice requires the entrepreneurs to meet with real customers there is a need to financially support it [13]. In contrast, the company might show some fears to directly approach real customers. Karlsson and Norström [27] observe that sending engineers to interact with customers might endanger the brand and customer relationship due to lack of knowledge of the company rules to interact with customers. Another fear is the risk of engineers to disclose classified information [27].

The customer related challenges address aspects related to the customer interaction. Karlsson and Norström [27] find that the customer interaction is performed by sales team instead of development team, and that obstructs the acquisition of feedback from the engineers.

Finally, entrepreneurs face two challenges during the product development process at this stage. Entrepreneurs might be tempted to believe that what customers tell is what they really want, being unable to unearth the problems that are really worth solving [50]. In contrast, entrepreneurs might concentrate on over analysing the customer feedback and refining their strategy plans [50]. The problem lies in the fact that customers do not really know what they want. Therefore, the focus should be to analyse the interaction between the products and customers [50].

	Organizational
GOOB	Risk of engineers disclosing classified information
	Brand/relation risk if customer interaction company rules not followed
	Financial support needed
	Customer
GOOB	Interaction only happens with sales, not with development team
	Product Development Process
GOOB	Temptation to start testing too early
	Analysis paralysis

Table 3.6: GOOB challenges

3.3.3 Testing practice: Minimum Viable Product (MVP)

One of the first mentions of the term "Minimum Viable Product" (from here on MVP) is introduced by Junk in the "The Dynamic Balance Between Cost, Sched-

ule, Features, and Quality in Software Development Projects" publication [26]. The MVP is understood as the minimum product feature set from which reducing any more features limits the product success [26]. Similarly, other concepts such as "Minimum Feature Set" [7] and "Minimum Markeatable Feature" [59] are used to emphasize the importance of reducing the time-to-market to launch the smallest product (feature set) that addresses the customer needs. In contrast, an MVP focuses on reducing the time-to-learn the feature set that addresses the customer needs. Ries uses the notion of MVP to define an artifact that is designed to materialize (into product features), test (quantitatively) and answer the unproven business hypotheses from real customers [50].

The MVP has several characteristics widely discussed in the literature. First, an MVP is the smallest version of the product required to proceed in the Build-Measure-Learn feedback loop [50]. As a consequence, it becomes an essential element to get through the Build-Measure-Learn process with the least amount of time and the minimum amount of effort [50, 51]. The result of the feedback loop is validated learning. The validated learning is achieved by measuring and collecting data from the customer interaction with the MVP. Therefore, the MVP enables the learning of which features of the product do or do not provide value to customers. Patz [49] expresses in similar terms, however, it presupposes that the MVP already provides value. In contrast, Münch et al. [42] claim that the MVP allows determining its value. Similarly, Gibson and Jetter [19] argue that the MVP demonstrates the value of the future product.

Second, an MVP must measure its impact against potential customers [50] [54]. For this reason, an MVP includes metrics for data collection [50] [52]. [13] and [19] have acknowledged that the MVP is built to collect customer feedback, however, they overlooked that an MVP strictly collects quantitative customer feedback via metrics [30, 50]. It is important to emphasize that an MVP is a quantitative test. Therefore, the feedback collected from customers using an MVP is quantified via metrics. This is one of the main strengths of Lean Startup, that, in addition to qualitative learning, it does quantitative testing to validate if the learnings are correct.

Another important aspect of MVPs is that it might be seen as an incomplete product [13, 42, 50]. Ries [50] argues with the idea of striving for perfection to build the first product from the traditional product development thinking, because first products are assessed by early adopters rather than the mainstream customers. Early adopters are customers that accept incomplete products and want to be the first to try the product, therefore, these customers accept and tolerate incomplete products.

Furthermore, an MVP is the beginning of the learning process. Consequently, an MVP can be considered the first experiment that evaluates the customer be-

haviour [51] [54]. In other words, the MVP starts the learning process and does not end it, it continues to learn in the next iteration. In contrast, design consultancies prototype and learn what the customers want, define the specifications for the product and provide the specifications to engineering teams, thus, assuming that all the learning have been done and stopping the learning [50]. There are three risks related to the preceeding passage. The design specification might become waste if the designers did not understand the customer needs well enough, or there were mistakes or the market changed [51].

Finally, [30] acknowledges a debate around an MVP versus a Minimum Desirable Product. In [13], it is noted that the "viable" term in MVP is misleading and should be "desirable" instead. However, that is precisely the advantage of an MVP, that is able to validate the desirability of a product through Build-Measure-Learn feedback loop, instead of producing a product an entrepreneur thinks it is desirable. Ries [50] insists to question every aspect of the strategy and product when building an MVP, including its quality and design attributes. Entrepreneurs do not know in advance if customers perceive the product as low or high quality. Therefore, entrepreneurs should use the MVP to "learn what attributes customers care about" rather than wasting efforts in improving its quality [50].

3.3.3.1 MVP benefits

An MVP affects positively the product development process, the customer interaction with the product and technical aspects of the product. Table 3.7 shows the MVP benefits classified by the aforementioned aspect dimensions.

The product development process benefits from an MVP because of its characteristic to build the minimum which is required to test a business hypothesis. As a result, the experiment takes shorter time to be built (days or a few weeks), can be cheaper and avoids wasting efforts to build other features from unproven assumptions [50]. In addition, it establishes a starting point for improving the product in each iteration of the process [50].

Similarly, an MVP also constructs the first understanding about customer behaviour making it more accurate than research [50]. Furthermore, testing the MVP with real customers (early adopters) allows entrepreneurs to capture customers creativity and feedback [50]. Specially in B2B, where the production process is known to be slow, the MVP can quickly expose new features and capture customer feedback in real time [52]. Additionally, after a well built MVP that provides the first set of customers, entrepreneurs can use this audience for the next MVP [51]. Consequently, by the time the product reaches the mass market, entrepreneurs are certain that the product is successful because it has been tested with real customers (early adopters) and growing audience. In contrast, traditional product development, release a product without having real proof that it will work against

the real customers [50].

Finally, Marciuska et al. [35] indicate that MVP can prevent or slow down the feature creep ("addition or expansion of features over time") consequences such as the addition of features with low value or that slow down the resulting software.

	Technical
MVP	Prevent feature creep
	Customer
MVP	Establish a baseline customer behaviour
	Capture customers creativity and feedback in real time
	Real customers pool grow over time assuring product success
	Product Development Process
MVP	Faster, cheaper and more accurate experiments
	Seed to continuous improvement

Table 3.7: MVP Benefits

3.3.3.2 MVP challenges

The Lean Startup methodology anticipates organizational culture challenges which its author calls "MVP speed bumps" referring to the impact it can have in the product development speed [50]. However, in the literature, we also identify technical and customer related challenges. Table 3.8 summarizes the MVP challenges classified by the aforementioned aspect dimensions.

This paragraph discusses the MVP challenges from the perspective of organizational culture. In some countries the patent law requires companies to register the patent right after releasing a product. As an MVP is not a final product, this law enforcement might inhibit the innovation progress of the product. In other cases, the patent is used to protect against competitors. The release of an MVP is justified if it does not give away an unprotected competitive advantage [50]. Ries [50] arguments that fearing the competitors stealing the idea is unfounded because, at first, it is challenging for a startup to get their product noticed by anyone. Even if a competitor would notice the idea, their challenge is to learn faster than the entrepreneurs that are developing the original idea. However, there is still a minor risk. So, in this thesis we consider it a challenge derived from MVP application. Another challenge is that launching an MVP together with public relation activities might damage the brand if the product fails [50]. In addition, the nature of an MVP is not to only test technical and design features, but also business assumptions. When an MVP fails, it can impact on the morale of entrepreneurs and drive them to give up the endeavour [50]. Furthermore, Ries claims that "any additional work beyond what was required to start learning is waste" [50].

Therefore, Ries [50] suggest to avoid making any effort that does not lead to the learning entrepreneurs are after. Finally, testing an MVP requires commitment to iteration: After an MVP fails it is easy to give up. However, after many iterations, entrepreneurs might be able to realize if there are any flaws in the product or strategy that would require a pivot [50].

The literature does not provide any study that analyses the customer related challenges derived from the application of an MVP, however, [54] reports that in B2B software companies the access to end-users is not direct and that complicates the collection of end-user feedback. Thus, limiting the understanding of customers behaviour. This gives an indication of the potential challenge the application of an MVP could have in B2B companies.

Finally, from the point of view of software maintenance, the fast speed the features change raises the risk of technical debt [40]. Similarly, the need for early value triggers the use of emergent architecture with the risk of causing technical debt [63]. However, it seems preferable to incur in technical debt if that assures the acquisition of customers and, therefore, business [62].

	Organizational
MVP	Patent protection might be compromised
	Fear about competitors about stealing the idea
	PR Branding damage risks
	Negative impact on teams morale
	Need to avoid temptation to overbuild and over promise
	Commitment to iteration reluctance
	Technical
MVP	Technical debt
	Customer
MVP	In B2B, indirect access to end-users complicates collecting feedback

Table 3.8: MVP challenges

3.3.4 Measuring practices: Innovation accounting

Innovation accounting is one of the least understood concepts by practitioners and researchers alike. Accounting is designed to prove that an employee or a manager is doing the job towards an expected (previously forecasted) results. However, Ries [51] argues that it is impossible to forecast the expected results of a product that does not exist. Alternatively, innovation accounting is used to quantify that learning that contributes to the development of a sustainable business [51].

This quantification is done using actionable metrics, that clearly demonstrate what marketing, design and engineering efforts reproduce certain customer behavior. Actionable metrics are obtained by performing split-test experiments and cohort-based metrics. A/B testing or split-testing is a marketing practice that the Lean Startup methodology adapts to product development. This practice consists of splitting the customers in two similar groups (cohorts), provide two versions of the product (split-test experiments) to both groups at the same time, and measure the impact of the variations (cohort-based metrics). [50]

3.3.4.1 Innovation accounting benefits

This section discusses the positive impact of Innovation accounting to the production process, the customers and the company. Table 3.9 outlines the Innovation accounting benefits below.

In product development it is challenging to identify which product features should be prioritized next [35]. However, innovation accounting helps discern the value-creating activities. Actionable metrics allow entrepreneurs to explain the real reason behind the gross numbers going up or down. Therefore, the metrics provide evidence that supports the entrepreneur's learning [50]. Subsequently, the product prioritization is driven by quantitative data [25]. Furthermore, innovation accounting enables the possibility to set learning milestones [50]. Thus, each learning milestones include all relevant data collected and validated learnings until it has been reached. The more compound validated learning (accumulated validated learning until the time) entrepreneurs have, the more they know about the customers, the market and the strategy. The compound validated learning enable entrepreneurs to accelerate the process of testing MVPs. Accelerating the process of MVPs allow entrepreneurs to validate or refute their next strategic hypothesis faster than before. Consequently, innovation accounting clarifies the timing when a pivot should happen and leads to faster pivots [50].

The interaction product-customer generates greater customer behaviour understanding and better accountability towards the customers. First, split-test experiments can expose concealed customer behavior [50]. Second, the cohort of customers resulting from the experiment are accessible to do qualitative research and further their behavior understanding [50]. Finally, the collected metrics can help analyze and support the learning about the researched customers [50]. The metrics can also assist in the accountability and transparency towards B2B or partnered customers [30].

The organizational culture benefits from innovation accounting because it provides quantified evidence. Therefore, learning milestones allow entrepreneurs to assess their progress objectively and accurately holding them accountable [50]. In addition, actionable metrics can be made auditable to improve the credibility

of the collected data and accessible to set a common language to settle disputes between managers and entrepreneurs [50].

	Organizational
Innovation accounting	Increase innovators accountability
	Higher credibility of collected data
	Common language between manager and innovator/entrepreneur
	Customer
Innovation accounting	Expose concealed customer behaviour
	Cohort of customers available for qualitative research
	Metrics support the learning about customer behavior
	Increase accountability towards customer
	Product Development Process
Innovation accounting	Metrics improvements demonstrate validated learning
	Data-driven product development prioritization
	Easier to determine pivot timing
	Faster pivots

Table 3.9: Innovation accounting benefits

3.3.4.2 Innovation accounting challenges

There are associated challenges in the practice of Innovation accounting. Table 3.10 summarizes the organizational and product development process related challenges.

As an internal startup, the customers are the end-users and the top management. This structure requires duplicate efforts to satisfy the end-user acceptance and the funding from top management [13].

The product development process becomes more complex, costly and time consuming by using split-test experiments, since that duplicates the number of metrics needed to supervise each variation [13, 50]. Ries [50] acknowledges that this added complexity exists, however, determines this as necessary for a greater benefit of learning.

	Organizational
Innovation accounting	Duplication of efforts for end-user acceptance and top management funding
	Product Development Process
Innovation accounting	Duplication of metrics increase complexity, costs and time consumption

Table 3.10: Innovation accounting challenges

3.4 Impact tables

The review of literature in this chapter has concentrated largely on the collection of benefits and challenges of applying the Lean startup steering practices to software companies. At first, corporate entrepreneurship has been introduced and used to explain the context in which software companies innovate to create new businesses. Subsequently, the Lean Startup methodology has been reviewed and divided in steering and acceleration practices. Finally, the steering practices Build-Measure-Learn, GOOB, MVP and Innovation accounting have been defined and analyzed to extract the benefits and challenges of its application. Thus, this section provides a basis for the next chapter in which the overall benefits and challenges are outlined and organized by four different dimensions: organizational, technical, customer and product development process dimensions. Table 3.11 and 3.12 contain the overall benefits and challenges respectively. The tables can be used for the analysis of the three empirical case studies results in the following chapter.

	Organizational
BML	Mindset shift towards a more innovative culture
	Employee motivation towards innovation
	Increase of team responsibility
	Increase innovation competency
	Break silos with cross-functional teams
Innovation accounting	Increase innovators accountability
	Higher credibility of collected data
	Common language between manager and innovator/entrepreneur
	Technical
MVP	Prevent feature creep
	Customer
BML	Increase customer understanding due to customer closeness
	Easier to collect direct feedback from customers
	Demonstration of customer value adding/destroying activities
	Reduction of experimentation time to validate ideas
	Higher end-customer acceptance
	Established customer base on mass market launch
	Being closer to customer business provides strategical advantage as a contractor partner
GOOB	Discover misguided plans
	Discern the right questions to ask
	Potential to improve the product
MVP	Establish a baseline customer behaviour
	Capture customers creativity and feedback in real time
	Real customers pool grow over time assuring product success
Innovation accounting	Expose concealed customer behaviour
	Cohort of customers available for qualitative research
	Metrics support the learning about customer behavior
	Increase accountability towards customer
	Product Development Process
BML	Customer validation added to the process
	Data-driven decisions improve process accuracy and speed
	Validation directs resources to increase product value and impact
	Fear dissipation about product quality and acceptance and brand damage
	Waste mitigation saves time and money
	Shorter feedback cycle
	Faster product/market fit
MVP	Faster, cheaper and more accurate experiments
	Seed to continuous improvement
Innovation accounting	Metrics improvements demonstrate validated learning
	Data-driven product development prioritization
	Easier to determine pivot timing
	Faster pivots

Table 3.11: Overall benefits

	Organizational
BML	Resistance to change towards an innovative culture
	Top management overprotection towards the company
	Top management innovation scope limitation to corporate strategy
	Top management lack of support towards the innovation team
	Lack of experimentation skills and Lean Startup practices knowledge
	Raises complaints from external teams for not following company procedures
	Lean Startup understanding rigidness
GOOB	Risk of engineers disclosing classified information
	Brand/relation risk if customer interaction company rules not followed
	Financial support needed
MVP	Patent protection might be compromised
	Fear about competitors about stealing the idea
	PR Branding damage risks
	Negative impact on teams morale
	Temptation to overbuild and over promise
	Commitment to iteration reluctance
Innovation accounting	Duplication of efforts for end-user acceptance and top management funding
	Technical
BML	Experimentation scope reduced with lack of user interfaces
	Reduced experiments reliability due to low end-user volume
	Experimentation infrastructure implementation on top of a mature project
	Difficult identification of value-adding measurable metrics
MVP	Technical debt
	Customer
BML	Customers can be doorkeepers
	Acceptance-tested software by customers before production release
	Fear of overpromising to end-customers
	Developed features come as requirements from customers
	End-users as customers' customers complicates feedback collection
	Legal agreements for usage data and user feedback collection
	Lead customer pro-activity required to develop the experimentation process
GOOB	Interaction only happens with sales, not with development team
MVP	In B2B, indirect access to end-users complicates collecting feedback
	Product Development Process
BML	Unclear hypotheses and results expectations might hinder the learning ability
	Company bureaucracy slows down the development speed
GOOB	Temptation to start testing too early
	Analysis paralysis
I.accounting	Duplication of metrics increase complexity, costs and time consumption

Table 3.12: Overall challenges

Chapter 4

Results

This chapter presents the results of three case studies of Finnish software companies. For each case, the most relevant results are selected from the transcribed interviews in the Appendix B based on the Research Questions and the scope of the study outlined in the Introduction section 1. The data is initially organized following the structure of the impact tables introduced in section 3.4. Therefore, the order in which the results are presented per each case follows this criteria:

- The results are divided in three groups: benefits, challenges and recommendations.
- In each group the findings are structured along organizational, technical, customer and product development process dimensions respectively.
- Within each dimension, the findings are reported depending if its impact is related to the whole Lean Startup methodology (labelled as BML) or to specific GOOB, MVP or Innovation accounting practices.

Each company positive and negative effects are, first, summarized in two tables (benefits and challenges tables). Subsequently, these findings are analyzed within each case, and the results are contrasted with the previously reported in the literature review gathered in the impact tables from section 3.4. Two new tables are created from the analysis including the findings found in the literature review and the new findings not present in the impact tables reported by the companies. (Extended tables including the empirical findings are available in appendix C.1 and C.2). Furthermore, an additional table with suggested recommendations from the case companies closes each case section.

Finally, the chapter concludes with a summary of the results combining, comparing and analysing the reported results of all three case studies. The summary is presented in three tables organized by the four selected practices in the literature review: Build-Measure-Learn, GOOB, MVP and Innovation accounting.

4.1 Company A

Company A is a large automotive software company that embedded software solutions and cloud computing and services for the automotive industry. Their business model is purely based on business to business (B2B) sales, mainly to car manufacturers. The interviewee (I-A) has a Head of department role.

4.1.1 Company A benefits

4.1.1.1 Organizational benefits

I-A indicated three organizational activities that have positive impact towards the Lean Startup application. According to I-A, "In COMPANY A the top management is involved. COMPANY A has a strong message in their business segments where it explains the way of working. It shows that the company adopted these practices fully. They started with Agile in 2007 in the wireless business segment. In 2011-12 there has also been a good shift in the culture, but still lots of things to do.". Therefore, first, the top management commitment helps the adoption of the methodology.

BML	Top management commitment helps with the adoption of the Lean Startup methodology

Second, the Lean Startup application influences the innovation culture mindset.

BML	The introduction of Lean Startup in the software company triggers a shift towards a more innovative culture

In addition, I-A reported that "Demonstrating the value of the model is something that must be done from the beginning and the company is beyond that. Also, customers understand this approach very well". Thus, third, communicating the way of working and demonstrating the value of the methodology early on helps the customers and employees to understand it.

BML	Customers and employees understand Lean Startup methodology value if this is communicated and demonstrated early on

4.1.1.2 Summary of Company A benefits

Table 4.1 illustrates the Lean Startup application benefits extracted from the Company A interview.

	Organizational
BML	Top management commitment helps with the adoption of the Lean Startup methodology
	The introduction of Lean Startup in the software company triggers a shift towards a more innovative culture
	Customers and employees understand Lean Startup methodology value if this is communicated and demonstrated early on

Table 4.1: Company A Lean Startup application benefits

4.1.1.3 Discussion of Company A benefits

In section 3.2.5, we discover that the Lean Startup requires the top management to be committed to change the company culture, adopting another management philosophy and supporting innovation teams. The previous findings in table 4.1 demonstrate that top management commitment helps with the adoption of the methodology. Coincidently, the literature review and this case findings match. It seems that introducing the Lean Startup has a positive impact to the company culture. This confirms that top management commitment to the methodology can influence the company mindset and shift it towards a more innovative culture.

This case study reports a new finding not listed in the literature review. The communication of the methodology early on contributes to a better understanding of the methodology value by customers and employees. Therefore, we can add it to the overall benefits model.

Table 4.2 highlights in bold the new positive effects identified by Company A.

	Organizational
BML	**Top management commitment helps with the adoption of the Lean Startup methodology**
	Mindset shift towards a more innovative culture
	Customers and employees understand Lean Startup methodology value if this is communicated and demonstrated early on

Table 4.2: Overall Company A benefits

4.1.2 Company A challenges

The challenges in Company A are organizational, customer and process related.

4.1.2.1 Organizational challenges

Organizational wise, I-A noted structural challenges in the team composition. The team must be formed with employees that understood the innovation culture required in the venture.

BML	Team members should understand the innovation culture

4.1.2.2 Customer challenges

I-A noted the importance of the customer role in the team. First, the team was described as a collaboration team between customers and developers that required a customer interface in order to work: "The team is set up so that there is a customer interface, only having a product owner is not going to work."

BML	Customer interface required in the collaboration team

Additionally, I-A expanded on how this team structure impacts the MVP practice. According to I-A, "Defining the MVP can be difficult due to conflict of interests between developers and customers."

MVP	Developers and customers conflict of interests complicates the MVP definition

4.1.2.3 Product development process challenges

The process related challenges are associated with the B2B transactional model. First, I-A recognized that "Being in B2B, it is important to understand the feedback, how customer is involved, and sometimes it is necessary to tailor the process to the customer".

BML	In B2B, it is necessary to tailor the process to the customer

Furthermore, I-A noted that if the feedback cycle is too short the amount of feedback collected is very low and that is detrimental to the process speed.

BML	In B2B, short feedback cycle limits amount of feedback and reduces the process speed

In contrast, having a too fast pace creates a bottleneck in the learning phase because the team is unable to absorb the learning from the customer feedback.

BML	In B2B, fast feedback cycle creates learning bottleneck

4.1.2.4 Summary of Company A challenges

Table 4.3 illustrates the Lean Startup application challenges extracted from the Company A interview.

	Organizational
BML	Team members should understand the innovation culture
	Customer
BML	Customer interface required in the collaboration team
MVP	Adding customer in the team complicates the MVP definition
	Product Development Process
BML	In B2B, it is necessary to tailor the process to the customer
	In B2B, short feedback cycle limits amount of feedback and reduces the process speed
	In B2B, fast feedback cycle creates learning bottleneck

Table 4.3: Company A Lean Startup application challenges

4.1.2.5 Discussion of Company A challenges

Table 4.3 indicates that innovation teams must be formed by employees that understand the innovation culture. The opposite, team members not understanding the innovation culture of the team, illustrates that team members have a different mindset than the required for the team. And, this mindset difference denotes a certain resistance to embrace a more innovative culture. Thus, we add this new challenge and the negative effect it has on the company culture that was already identified in the literature review in the table 4.4.

Company A reflects on the necessary role of the customer in the innovation team and argues that the absence of a customer representative can have negative effects on the innovation activities. It is important to highlight "collaboration team" and the distinction between "customer interface" and "product owner". This seems to indicate that the customer role is to be more of a co-creative partner rather than having decision power on what to build. Therefore, the customer should have a more pro-active role. The literature reports similar finding as the

"Lead customer pro-activity required to develop the experimentation process". Thus, we highlight this result in the table 4.4.

The customer presence in the team can cause unnecessary side-effects when building the first MVP. One of the reasons might be that the "Get out of the Building" practice was not used before defining the MVP. Another reason could be that this is the only point in the Build-Measure-Learn process that the decisions are opinion-based versus evidence-based. This finding highlights the importance of Lean Startup methodology main contribution: validated learning. After the first Build-Measure-Learn iteration, the decision-making and product prioritization can be grounded by validated learning. This finding was not reported in the litearture review. Thus, we add it to the table 4.4.

Table 4.3 shows that in B2B the customer role has an impact on the speed of the Build-Measure-Learn feedback cycle and requires the process to be adapted to the customer. There are two situations that impact the BML process. First, the amount of feedback collected from the customer might be insufficient, causing the loop to be halted until the results seem more reliable. Such negative effect is identified in the literature review under technical challenges. However, this empirical evidence shows that it is more related to the product development process. Thus, we move the negative effect from technical to product development process dimension in table 4.4. On the other hand, the team may not have enough time to learn if the feedback is captured too fast. This result has not been identified in the literature review. Therefore we add the discussed negative effect in the table 4.4.

Table 4.4 highlights in bold the new negative effects identified by Company A.

	Organizational
BML	Resistance to change towards an innovative culture
	Team members should understand the innovation culture
	Customer
BML	Lead customer pro-activity required to develop the experimentation process
MVP	**Adding customer in the team complicates the MVP definition**
	Product Development Process
BML	Reduced experiments reliability due to low end-user volume
	In B2B, it is necessary to tailor the process to the customer
	In B2B, fast feedback cycle creates learning bottleneck

Table 4.4: Overall Company A challenges

4.1.3 Company A recommendations

4.1.3.1 Organizational recommendations

Finally, two recommendations are derived from the interview with Company A. I-A recommended that a team should have "the role of the coach, that acts as support, or observation that helps in learning how to create and support the model, share it and develop it."

BML	Coach role to support, guide and develop the process

Another recommendation from Lean Startup practice in Company A was that "demonstrating the value of the model is something that must be done from the beginning... is a model not just used in development but in all levels in the segment (involve all functions).". Specifically, the value the methodology brings in all functions of a company, not just development.

BML	Demonstrate the methodology value early on to all company functions, not just product development

4.1.3.2 Summary of Company A recommendations

Table 4.5 illustrates the Lean Startup application recommendations extracted from the Company A interview.

	Organizational
BML	Coach role to support, guide and develop the process
	Demonstrate the methodology value early on to all company functions, not just product development

Table 4.5: Company A Lean Startup application recommendations

4.2 Company B

Company B is a large security software company, founded in 1988, that develops antivirus, cloud content and computer security software. COMPANY B joined Need for Speed research program to speed up the development of identified business opportunities. The interview concentrated on the development of a B2C PRODUCT by an internal startup using the Lean Startup methodology. The interviewee (I-B) has a director role.

4.2.1 Company B benefits

The interview with Company B uncovered benefits in all the chosen aspects.

4.2.1.1 Technical benefits

Another benefit I-B pointed out was the reuse of technology features. "Value propositions could reuse the same technology features to do many things, and it is not only about how they are implemented but also, how they are designed, and how they are visible in the product, and also, how they are marketed (what do we say within the product and externally. E.g. 1st screen in AppStore)".

MVP	Technology features can be reused

4.2.1.2 Customer benefits

Another benefit derived from the customer interaction was noted from the collection of cohort analysis: "We had good enough cohort analysis. We used it to mostly to understand the conversion of each page and what impact the changes had."

Innovation accounting	Cohort metrics enable better understanding of customer behavior

4.2.1.3 Product development process benefits

I-B commented that "the way of working with the customers worked really well". In this regard, Company B exposed the MVPs to real customers and the customer validation was performed with qualitative (focus groups with interviews, observation, usability workshops and narrative diaries) and quantitative (product usage analytics) feedback collection for market testing.

BML	Quantitative and qualitative feedback collection for customer validation works really well

Prior to develop the first working prototype, Company B split the process in two to define the product on a business and technical level in parallel and merged it back once the technical assumptions were validated. "Splitting the process was done to prevent delaying the project for 2,3 months that would have required to validate all the technical unknowns, and, also, to build a technology

BML	Split the process on business and technical level to save time

foundation COMPANY B did not have in place.". Therefore, splitting the process on a business and technical level saved time.

Another advantage noted by I-B was the speed to reach product/market fit. "During the product definition level COMPANY B found very quickly a product-market fit (2 iterations), by repeating many of the questions to verify the value propositions. After redefining the vision from the 1st focus groups feedback, the value propositions did not change, however, features did change."

BML	Faster product/market fit

On the measure phase of the product development process, I-B claimed the use of split-testing and surveys to collect indirect feedback for customer validation. "...there was a closed Beta version in Google Play app market and hundreds of customers were invited to test the product. The feedback was collected in 2 ways: indirect feedback via split testing and surveys. The indirect feedback via split testing was done by running a marketing campaign with Google Ads and Facebook and setting up 3 different landing pages to see which one converted best (A/B, split, multiple testing). After this, everyone who used the Beta received a survey request from which COMPANY B could get qualitative feedback."

Innovation accounting	Split-testing and surveys to collect feedback for customer validation

4.2.1.4 Summary of Company B benefits

Table 4.6 illustrates the Lean Startup application benefits extracted from the Company B interview.

	Technical
MVP	Technology features can be reused
	Customer
Innovation accounting	Cohort metrics enable better understanding of customer behavior
	Process
BML	Quantitative and qualitative feedback collection for customer validation works really well
	Split the process on business and technical level to save time
	Faster product/market fit
Innovation accounting	Split-testing and surveys to collect feedback for customer validation

Table 4.6: Company B Lean Startup application benefits

4.2.1.5 Discussion of Company B benefits

Table 4.6 recognizes that the application of the methodology facilitates the reuse of technology features despite variations in the product value propositions. In contrast, the literature review exposed that when building MVPs the feature set changes very quickly and that may incur in a high risk of technical debt (Table 3.12). This contradiction may be explained by the way Company B executed the process. Company B split the process in two to validate business and technical assumptions separately. Once the technical aspects were covered, Company B joined both sub-processes and used the validated architecture to build on top of it the set of features that would support the business hypotheses validation. Hence, technically speaking, the architecture was already validated. In addition, according to Company B they reached product/market fit really quickly. This could also explain why the features could be reused. If the technical features can be reused, the Lean Startup methodology can, as reported in the literature review, prevent feature creep. Therefore, we highlight in table 4.7 this positive effect identified by Company B.

Company B (Table 4.6) recognizes the importance and success of using the Lean Startup for customer validation, including qualitative and quantitative customer validation, and underlines how cohort analysis help understand end-users behaviour. Particularly, Company B recognizes the importance of data-driven customer validation when I-B explains that they used split-testing to collect feedback from their customers. In addition, Company B confirms that Lean Startup enables faster product/market fits, This supports one of the main benefits of the Lean Startup: data-driven customer validation improves the product development process accuracy and speed (Table 3.11). Thus, we highlight these benefits in table

4.7.

Finally, table 4.6 reports that splitting the process to validate business and technical assumptions in parallel makes better use of the team's time. It is debatable whether this affirmation is true in each case. In the Company B interview the merging of both technical and business validations was successful. However, they achieved product/market fit really fast. In the event that the business experiments would have not given successful results, that would have impacted on the technical validation. Thus, we add this finding to the table 4.7.

Table 4.7 highlights in bold the new positive effects identified by Company B and italicizes modified literature review findings.

	Technical
MVP	*Prevent feature creep by reusing technology features*
	Customer
I. accounting	Metrics support the learning about customer behavior
	Product Development Process
BML	Customer validation added to the process
	Data-driven decisions improve process accuracy and speed
	Faster product/market fit
	Split the process on business and technical level to save time

Table 4.7: Overall Company B benefits

4.2.2 Company B challenges

4.2.2.1 Organizational challenges

I-B expressed a few threats concerning the team skills and culture.

I-B defined the team structure to have market, technical and design skills. While I-B acknowledged the possibility to externalize the technical development of isolated parts of the product, I-B discouraged the outsourcing of design skills. "This (sub-contracting external designers that work outside COMPANY B premises) was a mistake because it caused slowness, it was not very practical and it created confusion."

BML	Design outsourcing creates slowness, confusion and is not practical

In addition, I-A reported that "Designers should have worked together on premises from the beginning, being closer to the team. Not doing that we lost

time. Also, internal resources would have been preferred, but the most important aspect was that the team should work together in the same location."

BML	The innovation team not working together in the same location loses time

Adding new team members had two challenges. First, the new member required time to learn the way of working. As I-B noted: "Beware of the learning curve, especially for developers.It takes time to learn the way of working.".

BML	A new team member requires time to learn how the team works

Second, the new member culture can influence negatively the internal team culture. I-B expressed that in these terms: "Since the team has an internal culture, you want to preserve that, and not take too many people at a time that could cause unavoidable "fireworks", meaning clash of strong personalities that could damage the culture."

BML	The addition of a new team member can damage the internal team culture

The team culture can also be disrupted externally with the top management resourcing power. I-B clarified that "Support from top management can become a heavy pressure in terms of "take more people and take more money", which was offered many times because they wanted to see this happening. Less is more. Small teams will be faster if you happen to have the right people. (more agile, no overhead)".

BML	Top management sponsorship pressure

Company B had one additional organizational challenge using the Lean Startup methodology in an internal startup. The communication of the Lean Startup practice failed and raised concerns amongst company employees. "We explained what we were doing but we did not do it well enough, thus, we suffered from that. Some reactions were in the line of "We are not a startup". Some associate it with kids having fun, and potential financial gains, risk and so on. For some means fun, for some means serious business. The following needs to be explained: the philosophy, the leadership thing, a way of working, highly iterative, lots of talking to customers. As it came as top-down, we had instructions to transform the company and develop something. We felt that we had the leadership, and we worked almost like a company. That worked but raised some concerns as some asked why we were doing everything by ourselves. The argument I used was that we are a startup."

BML	Failure in methodology evangelization raises concerns amongst company employees

4.2.2.2 Customer challenges

I-B warned that customer validation needs to be done with beta community customers and "general audience" customers to avoid biased results.

Innovation accounting	Customer validation needs to be done with beta community customers and "general audience" customers to avoid biased results

4.2.2.3 Product development process challenges

I-B noted that "In order to know what is statistically relevant it is important to have a big number of respondents."

Innovation accounting	Customer validation requires a big number of respondents to be statistically relevant

In addition, I-B implied that analyzing metrics for customer validation is complex. First, it was reported that Company B failed in the marketing test mechanics. Second, "the metrics were written in excel first, and later we used Omniture."

I. accounting	Customer validation mechanics is complex

Thus, the visualization of the metrics required analytics tools due to complexity.

Innovation accounting	Visualization of the metrics requires analytics tools due to complexity

Finally, the metrics grew over time making the analysis more challenging: "To know the measurements that should be analysed we started by defining metrics for the questions from the unknowns. In the end we would have 100s of variables, but we put some together to make some sense of it."

I. accounting	Metrics grow over time

4.2.2.4 Summary of Company B challenges

Table 4.8 illustrates the Lean Startup application challenges extracted from the Company B interview.

	Organizational
BML	Design outsourcing creates slowness, confusion and is not practical
	The innovation team not working together in the same location loses time
	A new team member requires time to learn how the team works
	The addition of a new team member can damage the internal team culture
	Top management sponsorship pressure
	Failure in methodology evangelization raises concerns amongst company employees
	Customer
Innovation accounting	Biased results if not validated with beta community and "general audience" customers
	Product Development Process
Innovation accounting	Customer validation requires a big number of respondents to be statistically relevant
	Customer validation mechanics is complex
	Visualization of the metrics requires analytics tools due to complexity
	Metrics grow over time

Table 4.8: Company B Lean Startup application challenges

4.2.2.5 Discussion of Company B challenges

According to the literature, the innovation team should be self-autonomous, cross-functional, securely funded and with independent authority. Company B exposed subtle variations to these characteristics that confirm potential negative effects due to Lean Startup application.

The top management might exert excessive pressure on the innovation teams (Table 4.8) jeopardizing its self-autonomy and independent authority by imposing too much funding or new team members and increasing the overhead. This can be understood as being too supportive in respect to the needs of the innovation team (to be more agile). This finding contrasts with the literature review, as it mentions that the lack of support from the top management to the innovation team can be a negative effect to the Lean Startup application. Thus, we should include as a negative effect "Lack or excess of support to the innovation team" in the table 4.9.

Furthermore, Company B (Table 4.8) indicates the importance of communicating the Lean Startup practices within the company. First, failing to communicate the methodology generates Lean Startup practice rejection within the software company and between employees. This explains what was reported in the liter-

ature review. External teams might complain because they do not understand why the innovative teams act differently and do not follow the company standard procedures. Second, Company B results show how challenging it is to keep the internal team culture protected from external disruptions. Company B reported that the addition of a new member can be damaging to the internal innovation culture. All these findings illustrate the resistance to change towards a more innovative culture reported in the literature from various angles. Thus, we highlight all these negative effects in the table 4.9, including the literature finding as it is a consequence of the repported findings by Company B.

An added challenge reported by Company B is the learning curve new team members face when joining the innovation team. This illustrates that Lean Startup application requires time to learn its practices and how to use them. In this context, it also demonstrates that not knowing Lean Startup practices beforehand is an undesired effect, as reported in the literature review. Thus, we report both in the table 4.9.

Finally, Company B experience suggests caution with the creation of cross-functional teams with sub-contractors, especially design sub-contractors, as that can create slowness, confusion and become impractical. A consequence of this is that the team does not work together in the same location and that has a negative impact on the time, as it requires more time to proceed with the product development activities. Thus, we add these findings to the table 4.9.

In relation to customer challenges, Company B (table 4.8) argued that customer validation should be done with two types of customers: beta-users and main audience. This reflection corresponds with the early adopter and mainstream customers reported in the literature review. However, Company B emphasizes that the lack of validation with both types of customers might cause biased results. We highlight and add both negative effects in the table 4.9.

Another challenge in table 4.8 is that the volume of respondents reduces the reliability of the collected feedback, which corresponds with the challenge in the table 3.12 under technical dimension. As discussed in the subsection 4.1.2.5 this challenge is related to the product development process. Thus, we move the negative effect from technical to product development process dimension in table 4.9.

Finally, Company B (Table 4.8) supports the idea that metrics grow over time, and, therefore, it adds complexity to the metrics analysis and its mechanics. The literature already reported that the duplication of metrics (due to the split-testing) can make the metrics grow in complexity. Therefore, we highlight the negative effect on the table 4.9.

Table 4.9 highlights in bold the new negative effects identified by Company B and italicizes modified literature review findings.

	Organizational
BML	*Top management lack or excess of support towards the innovation team*
	Failure in methodology evangelization raises complaints from external teams for not following company procedures
	The addition of a new team member can damage the internal team culture
	Resistance to change towards an innovative culture
	A new team member requires time to learn how the team works
	Lack of experimentation skills and Lean Startup practices knowledge
	Design outsourcing creates slowness, confusion and is not practical
	The innovation team not working together in the same location loses time
	Customer
Innovation accounting	**Biased results if not validated with beta community and "general audience" customers**
	Product Development Process
BML	Reduced experiments reliability due to low end-user volume
I.accounting	Duplication of metrics increase complexity, costs and time consumption

Table 4.9: Overall Company B challenges

4.2.3 Company B recommendations

I-B analyzed retrospectively Company B experience using the Lean Startup and suggested the recommendations reported below.

4.2.3.1 Organizational recommendations

I-B recognized the importance of the branding strategy and distinguished the trade-offs in using (or not using) the company brand for the internal startup: "...not to use so heavily the big company brand, it would be easier to make it faster, so that you don't have to follow brand guidelines, maybe also the reputation, we could try more things, we could do things more edgy and maybe hide parent brand totally. Arguments for using the company brand: leverage marketing, domain, reputation. We lose all that, and we don't want to build everything from ground up as it requires bigger investment. So, if the logic is eventually to merge the product..." Consequently, I-B suggested to be clear about the branding expectations upfront, and at the same time be ready to change it if that is required during the development process.

As a result of the bad experience outsourcing design activities, I-B suggested

BML	Clarify the branding strategy from the beginning but be flexible

to invest more on having design capabilities inside the company.

BML	Invest in design capabilities inside the company

I-B also emphasized the need for stronger leadership and communication of the Lean Startup methodology impact to middle management and other peers.

BML	Stronger leadership and communication of the Lean Startup methodology impact to middle management and other peers

Finally, evangelization of the Lean Startup should be directed to all functions, not just product development. I-B noted that "As a company we have approached this too much from product development, it just goes to how do we write code, but it feels disconnected if the rest of things are done in waterfall then we don't get the holistic LS. Changed this now as a company. Software development is the easy part of the transformation (to agile and lean)."

BML	Evangelization of the Lean Startup should be directed to all functions, not just product development

4.2.3.2 Technical recommendations

I-B insisted that "analytics should be placed in the frontend and backend." to draw the full potential of customer validation.

I. accounting	Frontend and backend systems should have metrics

4.2.3.3 Product Development process recommendations

I-B reiterated that "Process wise I would repeat the way of working together with customers. It worked well, very very well." referring to how qualitative and quantitative feedback was collected. Therefore, the combination of quantitative and qualitative validation was encouraged.

I. accounting	Combine quantitative and qualitative validation

4.2.3.4 Summary of Company B recommendations

Table 4.10 illustrates the Lean Startup application recommendations extracted from the Company B interview.

	Organizational
BML	Clarify the branding strategy from the beginning but be flexible
	Stronger leadership and communication of the Lean Startup methodology impact to middle management and other peers
	Evangelization of the Lean Startup should be directed to all functions, not just product development
	Invest in design capabilities inside the company
	Technical
I. accounting	Frontend and backend systems should have metrics
	Product Development Process
I. accounting	Combine quantitative and qualitative validation

Table 4.10: Company B Lean Startup application recommendations

4.3 Company C

Company C is a medium-sized business consulting company, founded in 2007, that focuses on digital service development, digital technologies, enterprise mobile solutions and analytics. The interview concentrated on the experience using the Lean Startup methodology in customer projects. The interviewee (I-C) has a software developer/DevOps specialist role.

4.3.1 Company C benefits

4.3.1.1 Customer benefits

I-C recognized that customers that allow Company C to get close to their business/strategical decision-making benefit from a better decision-making thanks to the Lean Startup practices: "In some projects we are really close with people that make the decisions, and we can help them to make better decisions, ... Sometimes it feels that we are 1 big company."

BML	Being close to the customers can help them do better business decision-making

4.3.1.2 Summary of Company C benefits

Table 4.11 illustrates the Lean Startup application benefits extracted from the Company C interview.

	Customer
BML	Being close to the customers can help them do better business decision-making

Table 4.11: Company C Lean Startup application benefits

4.3.1.3 Discussion of Company C benefits

Table 4.11 reports that software companies that are allowed to be close to their customer has a positive effect on the customer because Lean Startup practices provide practices for better decision-making. The literature review highlights the same benefit from the point of view of the software company. The consulting company can influence the strategic decisions of the customers and gain an strategic position as a partner. Therefore, we highlight both positive effects in table 4.12.

Table 4.12 highlights in bold the new positive effect identified by Company C.

	Customer
BML	**Being close to the customers can help them do better business decision-making**
	Being closer to customer business provides strategical advantage as a contractor partner

Table 4.12: Overall Company C benefits

4.3.2 Company C challenges

The interview with I-C raised one organizational challenge, general customer challenges and customer challenges related to the MVP practice.

4.3.2.1 Organizational challenges

I-C noted that in Company C there is no direct commitment to the Lean Startup practice from top management. Consequently, the methodology is not actively communicated to the customers as a company.

BML	Top management lack of commitment to apply and communicate the Lean Startup methodology

4.3.2.2 Customer challenges

Individual team leaders may decide to pitch and suggest the use of Lean Startup practices to customers. However, customers determine its applicability: "It is quite often depends on customers. They are used to follow waterfall, pitching scrum or agile is really hard already, so get the customer to know Lean Startup is really hard."

BML	Customers determine the way of working and if Lean Startup practices can be used

According to I-C, customers rigidness inhibited the possibility to develop the product faster: "... customers are used to work in cycles and they do not understand that it can go differently, ... we are not allowed to do the release and the production team decides that is a once in a month."

BML	Customers rigidness inhibits the possibility to develop the product faster

In addition, customers did not let the Company C to be involved in strategic decision-making: "... in some projects we cannot do anything they are too far. We are tied to development and not business level at all. ... We are external company, we are not part of the company, it is hard to, and don't want to that we come to their business side. There is a gap, ..."

BML	Customers do not let the consulting company to be involved in strategic decision-making

However, customers allow Company C to make technical decisions. In fact, customers try to push product feature prioritization decision-making to Company C because they are used to make decisions yearly: "Prioritization ... trying to push the decision to us, but scrum master has to make attention that it is the customer/product owner role to do that. We should help to make a more informed decision, but they should make the decisions ... do I really have to every month makes decisions, it requires so much time for me! People who make decisions they make once in a year decisions, you have to be ready to make decisions every week, all the time. They don't want to be every week making those decisions."

BML	Customers push product feature prioritization decision-making to the consulting company because they are used to make decisions yearly

Another minor challenge I-C reported was that Company C had no direct access to their customers' end users. However, the " customers handles out the collaboration with end users. So the feedback comes from our customers. ... Customers and us have access to the analytics results. ... Everyone has the access to that information." Therefore, quantitative and qualitative feedback collection and analysis was possible, even though the feedback was indirect. Regarding the MVP practice,

BML	The consulting company only has access to indirect quantitative and qualitative feedback

I-C noted that the MVP term is used but not well understood by customers and employees: "In communication we use the term MVP, sometimes people use it even though they dont know what it means."

MVP	MVP practice is misunderstood

Finally, hypotheses validation was avoided because customers do not need to prove the product feature usefulness: "In large companies, they have to decide and raise money for these features, so, when they get the money they have to build the features, regardless of it is useless or not."

MVP	Customers do not need and avoid validating hypotheses

4.3.2.3 Summary of Company C challenges

Table 4.13 illustrates the Lean Startup application challenges extracted from the Company C interview.

	Organizational
BML	Top management lack of commitment to apply and communicate the Lean Startup methodology
	Customer
BML	Customers determine the way of working and if Lean Startup practices can be used
	Customers rigidness inhibits the possibility to develop the product faster
	Customer do not let the consulting company to be involved in strategic decision-making
	Customers push product feature prioritization to the consulting company because they are used to make decisions yearly
	The consulting company only has access to indirect quantitative and qualitative feedback
MVP	MVP practice is misunderstood
	Customers do not need and avoid validating hypotheses

Table 4.13: Company C Lean Startup application challenges

4.3.2.4 Discussion of Company C challenges

In section 3.2.5, we discovered that the Lean Startup requires the top management to be committed to change the company culture, adopting another management philosophy and supporting innovative teams. Company C (Table 4.13) argues how difficult it is to convince customers to use Lean Startup practices and implies that the reason is the top management lack of commitment to apply and communicate the Lean Startup methodology. This finding corroborates that Lean Startup requirements reported in the literature review are relevant and how not having fulfilled those can create negative effects to the Lean Startup application. Therefore, we highlight the impact in the table 4.14.

The empirical results showed that the role of the customer is very important in the Lean Startup application. In the consulting business, the customer can exercise significant power in the innovation process. Table 4.13 shows three challenges the customer pose to the Lean Startup application. First, customers enforce the way to operate the innovation process. Second, customers might not accept that the consulting company participates in strategy decision-making. And, finally, customers attitude can slow down the product development process. All these challenges limit the potential benefits that Lean Startup can bring to customers and corroborates that customers can become doorkeepers for the Lean Startup application, as reported in the literature review. Therefore, we highlight these negative effects in the table 4.14.

In B2B and consulting companies, it appears to be difficult to have direct feedback with end-users. Instead, the customer collects the feedback and relays it to the innovation team (Table 4.13). The literature also underlines the difficulty to capture end-user feedback indirectly in B2B (Table 3.12). Thus, we highlight this negative effect in the table 4.14.

Table 4.13 presents a few unexpected results not reported in the literature. Customers avoid validating hypotheses and push decision-making to the consulting firm. These unexpected results have both a common aspect. The customer has an exploitation mindset. In contrast, as discussed in the literature, the Lean Startup is a methodology that is born to help with the exploration activities required to create a successful innovation. These results demonstrate the mindset clash that the consulting companies need to handle in order to successfully apply the Lean Startup in that setting. Therefore, we add these findings in the table 4.14.

Finally, table 4.13 reports a specific challenge related to the MVP. Company C claimed that the MVP term is misunderstood by customers. There is no recognized similar challenge in the literature. However, the literature discusses similar concepts such as Minimum Feature Set or Minimum Viable Product that support the potential confusion of the term. Thus, we include this finding in the table 4.14.

Table 4.14 highlights in bold the new negative effects identified by Company C.

	Organizational
BML	**Top management lack of commitment to apply and communicate the Lean Startup methodology**
	Customer
BML	**Customers determine the way of working and if Lean Startup practices can be used**
	Customer do not let the consulting company to be involved in strategic decision-making
	Customers rigidness inhibits the possibility to develop the product faster
	Customers can be doorkeepers
	End-users as customers' customers complicates feedback collection
	Customers push product feature prioritization to the consulting company because they are used to make decisions yearly
MVP	**MVP practice is misunderstood**
	Customers do not need and avoid validating hypotheses

Table 4.14: Overall Company C challenges

4.3.3 Company C recommendations

4.3.3.1 Organizational recommendations

I-C advised that the innovation culture mindset should be changed on a company and customer level for a successful Lean Startup application in a consulting setting.

BML	Innovation culture mindset to change on a company and customer level to enable Lean Startup application in a consulting setting

4.3.3.2 Customer recommendations

First, I-C proposed to convince and communicate that the Lean Startup practice requires making decisions on a weekly basis.

BML	Convince and communicate that the Lean Startup practice requires making decisions on a weekly basis

Second, I-C recommended to be really close to the decision-makers.

BML	Consulting companies should aim to be close to the decision-makers

Finally, I-C suggested to protect customer brand reputation by hiding the service developed with a temporary brand.

BML	Customer brand reputation protection under a temporary brand

4.3.3.3 Summary of Company C recommendations

Table 4.15 illustrates the Lean Startup application recommendations extracted from the Company C interview.

	Organizational
BML	Innovation culture mindset to change on a company and customer level to enable Lean Startup application in a consulting setting
	Customer
BML	Convince and communicate that the Lean Startup practice requires making decisions on a weekly basis
	Consulting companies should aim to be close to the decision-makers
	Customer brand reputation protection under a temporary brand

Table 4.15: Company C Lean Startup application recommendations

4.4 Summary of the results

In this section, we combine and compare the benefits, challenges and recommendations from the previous results observed from the empirical study. More precisely, we divide the discussion in the identified Lean Startup practices and inside each practice we analyse the positive or negative impact on organizational, technical, customer and product development process dimensions. Finally, we draw some conclusions based on the discussion and define a set of recommendations for the successful application of Lean Startup methodology in software companies. We only discuss the findings in the empirical study and leave out the discussion about other benefits and challenges found in the literature review.

4.4.1 Benefits of applying Lean Startup practices

4.4.1.1 Build-Measure-Learn benefits

Company A (Table 4.2) is the only case study that reported organizational positive effects from applying the Lean Startup methodology. The literature review suggests a combination of top management commitment with the adoption of learning as a unit of progress to foster a company culture mindset change. The empirical study confirms the importance of top management commitment and how their involvement, together with the application of the methodology, positively impacts the company culture towards a more innovative mindset. However, an unexpected result not reported in the literature review is the importance of communicating the value of the methodology early on. According to Company A, this would have a positive impact on the customers and employees, whom would understand better the Lean Startup value.

Company B emphasized three important characteristics of the Lean Startup methodology from which its application produce positive effects on the product

development process. First, the incorporation of qualitative and quantitative customer validation to the innovation process. Second, the inclusion of data-driven decision-making to the process via innovation accounting and split-testing, which in turn, improve the product development process accuracy and speed. And finally, the possibility to achieve faster product/market fits. In addition, Company B reports an unexpected result not found in the literature. Splitting the process to validate the business and technical assumptions in parallel makes better use of the innovation team's time.

Finally, Company C determines that getting closer to the customer has mutual benefits for both, the software company and the customers. On one hand, the consulting company gains a more strategic role as a partner. On the other hand, customers benefit from better business decision-making thanks to the Lean Startup practices leverage.

4.4.1.2 MVP benefits

The empirical results (Company B) only show one significant positive finding regarding the impact of the Lean Startup application on a technical level. During the MVP construction, the elaboration of value propositions allows reusing technology features (same features can support different value propositions), which can help prevent feature creep. The literature review emphasizes the same positive impact. However, the focus is on the ability of MVPs to discard low value features. Nevertheless, both findings suggest that the Lean Startup practice reduces the time needed to experiment and validate ideas.

4.4.1.3 Innovation accounting benefits

Company B argues that the innovation accounting practice demonstrates that the use of cohort metrics enable a better understanding of the customers behavior.

4.4.1.4 Lean Startup practices benefits table

Table 4.4.1.4 summarizes the most relevant positive effects identified in the empirical study. The bold and italicized items illustrate the new benefits not reported in the literature review. A complete positive impact table model including literature and empirical results can be found in the Appendix C.1.

Practice	**Benefit**	**Dimension**	**Company**		
			CA	**CB**	**CC**
BML	***Top management commitment helps with the adoption of the Lean Startup methodology***	***Organizational***	***x***		
	Mindset shift towards a more innovative culture	Organizational	x		
	Customers and employees understand Lean Startup methodology value if this is communicated and demonstrated early on	***Organizational***	***x***		
	Customer validation added to the process	Product Development Process		x	
	Data-driven decisions improve process accuracy and speed	Product Development Process		x	
	Faster product/market fit	Product Development Process		x	
	Split the process on business and technical level to save time	***Product Development Process***		***x***	
	Being close to the customers can help them do better business decision-making	***Customer***			***x***
	Being closer to customer business provides strategical advantage as a contractor partner	Customer			x
MVP	***Prevent feature creep by reusing technology features***	***Technical***		***x***	
Innovation accounting	Metrics support the learning about customer behavior	Customer		x	

Table 4.16: Summary of the benefits of applying Lean Startup practices

4.4.2 Challenges of applying Lean Startup practices

4.4.2.1 Build-Measure-Learn challenges

The three case studies reported organizational negative effects of applying the Lean Startup methodology. Particularly the resistance to change the existing company culture towards a more innovative mindset. All three cases demonstrate that changing the company culture is the most significant organizational challenge. In fact, this negative effect (resistance to change mindset) embraces and derives other negative effects. The literature review described the sources of this resistance to come from external teams or the top management.

The empirical study uncovers many sources of external rejection. Company B points to the lack of Lean Startup practices communication as the responsible for the complaints from external teams. In addition, Company A (Table 4.4) and Company B (Table 4.9) noted that adding new team members that do not understand the innovation team culture might resist and damage its internal culture. Similarly, Company B (Table 4.9) commented on the steep learning curve new team members must face, thus, representing a lack of Lean Startup practices knowledge that has a negative impact on the innovation team. Other negative effects from the Lean Startup application come from the top management lack of support to the innovation team. The empirical study revealed two opposed extremes that cause such effects. On the one hand, Company C (Table 4.14) admitted the lack of top management commitment to actively communicate the benefits of the methodology. On the other hand, Company B (Table 4.9) showed that top management overzealousness for achieving results can put excessive pressure to the innovation team by adding unneeded overhead that might slow down or damage the expected results. The empirical study also revealed two undesired negative effects not identified in the literature review. First, the use of sub-contracted design team members creates slowness, confusion and is impractical. Second, the innovation team not working together in the same location causes time delays in the development of the product development activities.

From the customers perspective, the empirical results showed that the more exposure to the customer there is, the more bargaining power the customer has, and more difficult it is to apply the methodology. B2C and B2B, both have in common that the product is owned by the software company. The difference between B2C and B2B relies on the volume of customers, which can determine the quality of the feedback (Company A - Table 4.4 and Company B - Table 4.9) and the need for the customer to take a more pro-active role during the experimentation process (Company A - Table 4.4). In contrast, a consulting company develops customers products. Therefore, the customer can exercise significant power in the innovation process. The most significant negative effect is the doorkeeping power customers

gain (Company C - Table 4.14). Such position can determine the application of the methodology (customers determine the way of working), the speed of the product development process (Customer rigidness inhibits faster product development) or the transparency between the software company and the customers (Customers do not allow the consulting company to be involved in strategic decision-making) (Company C - Table 4.14). In addition, the customer blocks the collection of direct feedback from the end-users making customer validation more complex (Company C - Table 4.14). Furthermore, the empirical study reported that customers push product feature prioritization decision-making to the consulting firm because they are used to make decisions yearly (Company C - Table 4.14). These unexpected results demonstrate that the customer company culture needs to change from an exploitation mindset towards a more innovative and exploration mindset, which requires frequent decision-making.

The application of the Lean Startup practices, particularly, Build-Measure-Learn process have negative effects on the product development process too. In B2B, the product development process speed plays a crucial factor. According to Company A (Table 4.4), too fast speed (short feedback cycle) can generate two opposed scenarios. If the feedback is considerable, the team may not have enough time to handle the feedback and cause a learning bottleneck halting the process. On the other hand, the amount of feedback collected from the customer might be insufficient, reducing the reliability of the experiments. Thus, disabling the possibility to learn and continue to the next iteration and, therefore, slowing down the process. The same negative effect is detected by Company B (Table 4.9).

4.4.2.2 MVP challenges

Regarding the MVP practice, in B2B the customer presence in the innovation team can complicate the MVP definition due to conflicts inside the team between customers and developers (Company A - Table 4.4). Such effects are very similar to the organizational negative effects caused by the addition of external team members to the innovation team. Both, illustrate a clash of different mindsets. Moreover, customers usually misunderstand the MVP term (Company C - Table 4.14), which supports the reasoning why it is complicated to add customers to the innovation team. In a consulting context, there is an unexpected and revealing negative effect that impacts on the Lean Startup applicability. Customers avoid validating hypotheses because they do not need to (Company C - Table 4.14). This power customers have reduce the MVP practice purpose to its minimum.

4.4.2.3 Innovation accounting challenges

In B2C, similarly to what is reported in the literature review, Company B (Table 4.9) insisted on performing customer validation to two types of customers: beta-users (early-adopters) and main audience (mainstream customers). Neglecting this, might have a negative effect which is the collection of biased results for not taking into account both types of customers. In addition, Company B (Table 4.9) also reported that the innovation accounting practice to split-test duplicates metrics making them (and customer quantitative validation) grow in complexity.

4.4.2.4 Lean Startup practices challenges table

Table 4.17 summarizes the most relevant negative effects identified in the empirical study. The bold and italicized items illustrate the new challenges not reported in the literature review. A complete negative impact table model including literature and empirical results can be found in the Appendix C.2.

Practice	Challenge	Dimension	Company		
			CA	CB	CC
BML	Resistance to change towards an innovative culture	Organizational	x	x	
	Adding team members that do not understand the innovation culture can damage the internal team culture	***Organizational***	***x***	***x***	
	Top management lack or excess of support towards the innovation team	***Organizational***		***x***	
	Top management lack of commitment to apply and communicate the Lean Startup methodology	***Organizational***			***x***
	Failure in methodology evangelization raises complaints from external teams for not following company procedures	***Organizational***		***x***	
	A new team member requires time to learn how the team works	***Organizational***		***x***	
	Lack of experimentation skills and Lean Startup practices knowledge	Organizational		x	
	Design outsourcing creates slowness, confusion and is not practical	***Organizational***		***x***	
	The innovation team not working together in the same location loses time	***Organizational***		***x***	
	Customers can be doorkeepers	Customer			x
	End-users as customers' customers complicates feedback collection	Customer			x
	Lead customer pro-activity required to develop the experimentation process	Customer	x		
	Customers determine the way of working and if Lean Startup practices can be used	***Customer***			***x***
	Customer do not let the consulting company to be involved in strategic decision-making	***Customer***			***x***
	Customers rigidness inhibits the possibility to develop the product faster	***Customer***			***x***
	Customers push product feature prioritization to the consulting company because they are used to make decisions yearly	***Customer***			***x***
	Reduced experiments reliability due to low end-user volume	Product Development Process	x	x	
	In B2B, it is necessary to tailor the process to the customer	***Product Development Process***	***x***		
	In B2B, fast feedback cycle creates learning bottleneck	***Product Development Process***	***x***		
MVP	***Adding customer in the team complicates the MVP definition***	***Customer***	***x***		
	MVP practice is misunderstood	***Customer***			***x***
	Customers do not need and avoid validating hypotheses	***Customer***			***x***
Innovation accounting	***Biased results if not validated with beta community and "general audience" customers***	***Customer***		***x***	
	Duplication of metrics increase complexity, costs and time consumption	Product Development Process		x	

Table 4.17: Summary of the challenges of applying Lean Startup practices

4.4.3 Recommendations for applying Lean Startup practices

4.4.3.1 Build-Measure-Learn recommendations

In the previous section, it has been discussed that the top management lack of commitment and lack of promotion of the Lean Startup is the root cause for the external challenges the innovation teams suffer from the top management, external teams and customers. The interviewees from the empirical study shared a set of recommendations to overcome this resistance to change the innovation mindset within the company. Table 4.5 suggest to demonstrate the value the Lean Startup brings in the software company to all the functions of the company very early on. In a similar line, Table 4.15 suggests to do the same with customers. Furthermore, Table 4.10 insists in the top management to take strong leadership and an active role in communicating the Lean Startup impact within the software company. All in all, it seems to be clear that to successfully apply the Lean Startup a change in the innovation culture mindset is need. And, for that to happen, the top management commitment to promote early on the value of the methodology and to lead the change is required. As noted in Table 4.15, the innovation mindset change needs to be extended to the customers when the software company is acting as a consulting company. For this reason, Table 4.15, also recommends the software company to be close to the customer decision-makers to convince them of the value of the Lean Startup methodology.

An interesting recommendation reported in Table 4.5 is the role of the coach in an innovation team. The corporate entrepreneurship literature exposed the figure of a champion to guide and assist the innovation team in a similar manner as described by the Company A. It is debatable if a champion is needed, both, inside the team or externally. However, the earlier paragraph discussed the need of leadership and promotion activities. Such activities could be combined in a champion role or a champion team.

Another recommendation listed in Table 4.10 is the need to invest in design capabilities inside the company. Company B demonstrated with their experience that it is not advisable to externalize certain functions in the team to external companies. Therefore, caution should be recommended when making a decision to grow in-house or externalize certain capabilities.

According to the literature (Table 3.12), there are two risks in damaging the brand reputation. One risk is rooted on the interaction between developers and customers. There is a fear that not following the proper company etiquette to communicate with customers might endanger the company brand and customer relationship. Such risk has not appeared in the empirical study. The second risk is the impact a product failure might have in the brand of the company.

The latter risk is reported in the empirical study and tables 4.10 and 4.15 report two recommendations about the protection of brand reputation from the software company or customers. As Company B noted (Table 4.10), it is advisable to define a branding strategy to decide whether the new product innovation will use the company brand or not. On the other hand, Company C (Table 4.15), suggests the creating of a temporary brand to protect the customers' brand.

4.4.3.2 Innovation accounting recommendations

Company B recommended to add metrics in front-end and back-end systems to make full use of the customer validation. This recommendation collides with the technical challenge reported in the literature review, where, in B2B, there can be situations where the experimentation scope is reduced due to lack of user interfaces (front-end). Thus, the recommendation should be to add metrics to front-end and back-end systems to use the full power of customer validation, whenever possible.

Company B reported a significant recommendation (Table 4.10): the combination of quantitative and qualitative feedback collection and validation. The previous section established the importance of customer validation to better understand customer behavior. In contrast, it was argued that customer validation is not exempt of challenges. Nevertheless, it should be noted that the Lean Startup methodology is useless without customer validation practices. After all, validated learning is one of the main principles Lean Startup is based on. This validated learning is achieved via qualitative learning and quantitative testing. Therefore, the recommendation to combine quantitative and qualitative feedback collection and validation is very advisable.

4.4.3.3 Lean Startup practices recommendations table

Table 4.18 summarizes the most relevant recommendations for the Lean Startup methodology application identified in the empirical study.

Need to add the Demo to all functions in the summary of results

Practice	**Recommendation**	**Dimension**	**Company**		
			CA	**CB**	**CC**
BML	Stronger leadership and communication of the Lean Startup methodology value and impact to customers and employees early on	Organizational	x	x	x
	Demonstration of the Lean Startup benefits in all company functions, not just product development	Organizational	x	x	
	Innovation culture mindset to change on a company and customer level to enable Lean Startup application in a consulting setting	Organizational			x
	Consulting companies should aim to be close to the decision-makers	Customer			x
	Coach role to support, guide and develop the process	Organizational	x		
	Invest in design capabilities inside the company	Organizational		x	
	Protect the customer or software company brand reputation early on	Organizational		x	x
Innovation accounting	Frontend and backend systems should have metrics	Technical		x	
	Combine quantitative and qualitative validation	Product Development Process		x	

Table 4.18: Summary of the recommendations of applying Lean Startup practices

Chapter 5

Discussion

This chapter presents in a more concise manner answers to the RQs by drawing the main conclusions and learnings from the literature and all the case studies.

Finally, in the subsection 5.3, we will draw recommendations from the empirical study and the earlier discussion and answer the Research Question 3.

5.1 RQ1: What are the positive effects of applying Lean Startup practices in software companies?

The results of the empirical study exposed the positive effects of applying Build-Measure-Learn (BML), MVP and Innovation accounting practices, excluding the GOOB practice. The benefits mainly concentrate on the Build-Measure-Learn practice (9 out of 11 identified positive effects). Thus, most of the reported positive effects are caused by the Lean Startup application as a whole and not due to specific practices (In this thesis The BML is understood as the whole Lean Startup methodology). The most important results of the empirical study are, first, briefly summarized below, and later discussed and compared with the existing literature.

The application of the Build-Measure-Learn process demonstrated a positive impact on organizational, customer and product development process dimensions. From the reported results, two dimensions are significantly important. On an organizational level, the top management commitment in the methodology application has a positive impact on the adoption of the Lean Startup practices and on the company culture towards a more innovative mindset. In addition, communicating and demonstrating the value of the methodology early on contributes to the customers and employees understand better the Lean Startup value. On a product development process level, the Lean Startup methodology provides qualitative and

quantitative customer validation to the innovation process, supports data-driven decision-making that improves the process accuracy and speed and enables faster product/market fits. Another relevant positive effect is reported from the application of the innovation accounting practice. The use of cohort metrics help to understand and learn from the customer behavior.

On an organizational level, the empirical study validates that top management commitment to the methodology is required to have a positive impact on the company culture towards a more innovative mindset and to ease the adoption of the Lean Startup methodology within the software company. Similarly, the literature clearly states that Lean Startup application requires the top management to commit and support the methodology application and the company culture should be of an innovative kind [2, 13, 21, 30, 50, 52]. Particularly, the literature reported that a change in learning mindset is needed to embrace a more innovative culture [21, 30]. The literature exposed two other positive organizational effects not clearly identified in the empirical study. The Lean Startup application should raise the innovation competency, the innovation teams motivation [13, 21, 30] and break silos with the formation of cross-functional teams [30]. Another significant finding the empirical study did not reveal, but present in the literature, is the main positive effect of Innovation accounting practice: the gathered quantified evidence provides accountability, credibility and accessibility to management and customers [30, 50]. In contrast, a significant finding provided by the empirical study was not been identified in the literature. Communicating the value of the methodology early on contributes to the customers and employees understand better the Lean Startup value. In this case, the literature warns that knowing lean and agile practices beforehand can provide added value to the software company. However, the empirical study shows strong evidence that active communication of Lean Startup methodology value is needed for its adequate application.

The empirical study confirms the literature positive effects on the product development process dimension. Both agree that the Lean Startup application adds (quantitative and qualitative) customer validation to the product development process. That is, the application of Lean Startup makes it possible to get feedback from customers to validate the customer behavior against the new products (MVPs) and capture data that is used for decision-making and validate the learnings about customers [50].In addition, the results indicate that the methodology application enables data-driven decision-making that improves the process speed and accuracy [46, 50, 52] and faster product/market fits [13]. However, the literature adds that customer validation makes good use of the product development resources: time and money [50]. Particularly, the MVP practice enables a cheaper, faster and more accurate product development process, which, results in a shorter Build-Measure-Learn feedback cycle [13, 21, 52]. Two implied positive effects

not directly reported in the empirical study come from the Innovation accounting practice. First, quantitative data-driven decisions support a better product prioritization [25]. Second, the compound validated learning collected after each iteration enables easier and faster pivots.

Another significant positive effect reported by the empirical study that confirms the literature is that the Innovation accounting practice, with its cohort metrics, provides evidence of expected and unexpected customer behavior with the product [50]. However, the literature includes other practices that complement this positive effect. For instance, the GOOB practice provides early customer qualitative validation [7, 50], the MVP practice establishes a baseline customer behavior [50] and the Build-Measure-Learn process increases the customer understanding and identifies customer value adding activities [21, 46, 50]. Thus, the Lean Startup methodology provides other practices to learn from and understand better the customer behavior. In any case, the empirical results at least confirm that innovation accounting is a practice that can be used for learning about the customer behavior. The literature review reports two other significant positive effects from being close to customers not directly reported in the empirical study. First, the Build-Measure-Learn process, and specifically MVP practice, allow getting direct feedback from real customers in real-time and capture their creativity [21, 50, 52]. Second, the Lean Startup practices ensure a higher end-user acceptance by the time the product is launched to the mass market [30, 50]: The MVP practice provides incomplete products initially only accepted by early adopters; the Innovation accounting practice provides a cohort of customers ready for further qualitative research; After a few product optimizations (Build-Measure-Learn iterations), the number of customers may grow and provide a pool of customers that already accept the product as it is by the time the product is launched to a bigger market.

The literature reports other benefits about the innovation accounting practice, such as its metrics demonstrating validated learning [50], data-driven product development prioritization [25] and faster pivots [50]. This measuring practice positive effects indicate that innovation accounting is the actual quantitative practice behind the quantitative customer validation and data-driven decision making positive effects reported by the empirical study in the previous paragraph. Thus, we can extend the previous product development process positive effects adding that the Lean Startup application also supports the learning about customer behavior via innovation accounting. We can acknowledge, then, that the Lean Startup provides a fast learning-driven product development process.

5.2 RQ2: What are the negative effects of applying Lean Startup practices in software companies?

The results of the empirical study exposed the negative effects of applying Build-Measure-Learn (BML), MVP and Innovation accounting practices, excluding the GOOB practice. The challenges mainly concentrate on the Build-Measure-Learn practice (19 out of 24 identified negative effects). Thus, most of the reported negative effects are caused by the Lean Startup application as a whole and not due to specific practices (In this thesis The BML is understood as the whole Lean Startup methodology). The most important results of the empirical study are, first, briefly summarized below, and later discussed and compared with the existing literature.

The application of the Build-Measure-Learn process demonstrated a negative impact on organizational, customer and product development process dimensions. On an organizational level, there is a strong resistance to change the existing company culture towards a more innovative mindset. Particularly, the innovation teams that practice the Lean Startup methodology suffer from external rejection or lack of support from the top management. The external rejection is caused by the lack of proper communication of the Lean Startup practices potential benefits to external teams and the lack of sufficient Lean Startup knowledge from external members. Moreover, new team members require time to learn the Lean Startup practices and adding they do not understand the innovation team culture their addition to the team might damage its internal culture. On the other hand, the top management lack of commitment to actively communicate the benefits of the methodology or their excess of overzealousness for results can put excessive pressure to the innovation team. Another significant negative effect is that subcontracting design team members is impractical and creates slowness and confusion. Additionally, the innovation team not working together in the same location causes time delays in the development of the product development activities. On a customer level, customers can become doorkeepers the more decision power they have. This has negative consequences in the Lean Startup methodology application because customers decide the way of working and their stiffness can influence the speed of the product development process. Finally, on a product development process level, the amount of customer feedback can be excessive creating a learning bottleneck and slowing the process. On the other hand, the amount of feedback collected from the customer might be insufficient, reducing the reliability of the experiments and process speed. In both cases, the process might require tailoring. The MVP practice application demonstrated negative effects related to the

customers too. First, in B2B the customer presence in the innovation team can complicate the MVP definition due to conflicts inside the team between customers and developers. Second, customers misunderstand the MVP term.

The empirical study supports the literature review in that the biggest negative effect from applying Lean Startup methodology is the resistance from top management, external teams and customers to change their company culture from an exploitation mindset to an exploration mindset (innovative mindset). Such resistance is shown strongly in the software company but also in the customer company culture. The Build-Measure-Learn practice empirical results match with the literature review with the causes and negative effects of the external rejection of the Lean Startup application by external teams. First, both agree that the lack of proper communication of the Lean Startup practices potential benefits to external teams raises complaints from them [13]. Second, there is insufficient Lean Startup knowledge [30, 52]. Third, the lack of knowledge requires the new team members to be educated [52], and the empirical studies add that these require time to learn the Lean Startup practices. A new finding from the empirical results not identified in the literature sheds some light in the reasons why this external rejection happens. Adding new members that do not understand the innovation team culture might damage the innovation team internal culture. Thus, the lack of understanding of the Lean Startup practices is an added factor to the initial rejection of the methodology. There is a certain discrepancy regarding the lack of top management commitment to apply the Lean Startup methodology. The empirical results show that in a consulting context, the software company's top management fears the customer rejection to adopt the Lean Startup practices. Thus, the top management neglects the communication of the methodology's potential benefits. However, the literature review argues that the top management lack of support and commitment to the methodology application lies on the need to protect their existing exploitation activities [13]. Nevertheless, both, empirical and literature results demonstrate the unavoidable clash between exploration and exploitation activities. In contrast, another empirical finding that was not reported in the literature review shows that the top management eagerness to conduct innovation activities can also jeopardize the correct application of the Lean Startup methodology due to strong pressure on the innovation team with excess of resources. The empirical study also confirmed resistance to change from the customer. This opposition becomes more obvious the more decision and ownership power the customer has. Literature and empirical results agree that, in a consulting context, the customer is the product owner. Therefore, it gives the customer the power to determine the way of working (customers decide which Lean Startup practices can be used) or the speed of the product development process. Similarly, the MVP practice uncovered new negative effects not accounted for in

the literature review that show the customer resistance to change their mindset. First, customers misunderstand the MVP term. Second, customers clash with the developers mindset complicating the MVP definition. Consequently, the empirical study supports the view that customers can become doorkeepers preventing the Lean Startup application [30]. In contrast, another significant finding not reported by the empirical study reveals that the responsibility of the resistance to change, in this consulting context, from the customers does not solely fall on the customer but on the software company. The software company might decide to avoid the Lean Startup application due to fear of not providing the expected user experience or fear to overpromise to customers [21, 52].

The remainder of significant negative effects summarized in this section have in common that the impact concentrates on the product development process speed. Particularly, there are a few factors that reduce its speed. The empirical results show that sub-contracting design team members is impractical and creates slowness and confusion. Similarly, the innovation team not working together in the same location causes time delays in the development of the product development activities. Thus, both emphasize the negative impact dispersed teams have on the product development speed. None of the previous negative effects were identified by the literature. On a customer level, the empirical results point out that customers decide the way of working and that their rigidness inhibits the possibility to develop the product development faster. Both findings illustrate the identified negative effect from the literature, that customers can become doorkeepers [30].In this case, customers determine the way of working (which Lean Startup practices can be used). The literature described the benefits of the Build-Measure-Learn process. Amongst them, data-driven decisions improve the product accuracy and speed [50]. Thus, customers blocking the usage of the methodology's practices has a negative impact on the product development speed. Another relevant negative effect reported by the empirical study that supports the literature results is related to the customer feedback collection. Build-Measure-Learn practice reveals the identified risk of getting insufficient customer feedback, causing low experiments reliability [52]. The consequences of insufficient feedback is that it disables the possibility to learn and continue to the next iteration. This hampers the product development process and reduces its speed. The literature review exposed challenges in the execution of GOOB practice (and feedback collection) that were not identified during the empirical study. According to the literature, software companies fear the customer interaction between engineers and customers as that might ruin the customer relationship or the disclosure of confidential information [27]. In contrast, the empirical study revealed a new finding not reported in the literature review. The Build-Measure-Learn process fast speed can also cause a learning bottleneck. This affects the process speed as it requires more time to

process all the learnings and the process needs to be adapted and its speed is reduced.

5.3 RQ3: What are the recommendations to successfully apply Lean Startup practices in software companies?

The empirical study uncovered a set of recommendations for software companies to successfully apply the Lean startup methodology. The recommendations are related to Build-Measure-Learn and Innovation accounting practices. However, no relevant recommendations have been formulated from applying GOOB or MVP practices.

The empirical study suggested the following set of recommendations when applying the Build-Measure-Learn process (or the Lean Startup methodology). First, the software companies should have strong leadership to apply the Lean Startup and should communicate the value and impact of the methodology very early on. Second, software companies should also demonstrate the Lean Startup benefits in all the company functions, not just on product development. Third, consulting software companies and their customers should adapt their company culture to integrate a more innovative mindset. Therefore, consulting software companies should be close to their customers decision-makers to enable the value of Lean Startup application. Fourth, a coach role is advisable to support, guide and develop the process. Fifth, software companies should invest in in-house design capabilities. Finally, the brand reputation of customers or software companies should be protected by defining a branding strategy early on. The empirical study suggested two recommendations for the application of Innovation accounting practices. First, the empirical study suggest to add metrics in front-end and back-end systems to make full use of the customer validation, when the product allows it. Second, customer feedback collection and customer validation should be quantitative and qualitative to achieve validated learning.

The empirical results demonstrated that the current software company and customer mindset has a huge influence and can determine the success of the Lean Startup application. Therefore, the empirical study and the positive and negative effects collected in the previous sections emphasize very clearly that to successfully apply the Lean Startup there should be a stronger top management leadership and commitment in communicating very early on to external teams (all company functions) and customers the value and benefits (fast learning-driven approach to create new businesses) of the Lean Startup and how the methodology will affect the current practices. The communication of the Lean Startup value is key to reduce

negative effects such as resistance to its application, a change of company culture mindset (customer doorkeeper attitude) and the misunderstanding or misinterpretation of its practices. In addition, the literature review and the empirical study indicate that a figure of a champion that has a coaching role could contribute to a better Lean Startup application. In the context of consulting software companies, it is recommended to be close to the customer decision-makers to convince them of the value of the Lean Startup methodology and make them more receptive to its application. This recommendation would support the positive effect of establishing a strategic partnership with customers and prevent negative effects such as the lack of collaboration from customers. Another recommendation reported in the empirical study is to exercise caution with the externalization of certain functions in the team to external companies, especially design capabilities. This recommendation would correct the reported negative effect of sub-contracting design team members. Although no negative effects have been reported regarding the branding of the innovative products, the empirical study raised its concern on the branding reputation of software companies and customers due to the application of Lean Startup practices. The recommendation is to define a branding strategy that decides if the new product uses the company/customer brand or a temporary brand. The technical and product development process Innovation accounting practices recommendations from the empirical study support the Innovation accounting practices positive effects reported in section 5.1. However, they also intensify one negative effect related to the customer feedback collection and customer validation complexity reported in section 5.2. Particularly, the addition of more metrics in the back-end and front-end systems increases the validation and feedback collection complexity. Nevertheless, the literature review reports this negative effect as necessary for the greater benefit of learning [50].

Although MVP is one of the most promising practices from the Lean Startup methodology, the empirical study did not report significant recommendations about this practice. This might be explained with how the MVP related challenges show that the customers resist to adopt a more innovative mindset. Therefore, the previous recommendation to change the company culture mindset on a customer level includes a recommendation for this practice. However, a recommendation not reported in the empirical study can be formulated from the analysis of the positive and negative effects from the empirical results. Particularly, a recommendation can be derived from the MVP practice application positive effects. The detachment of technical features from value propositions can help prevent feature creep. This recommendation would reduce the risk of technical debt reported as an MVP practice negative effect.

5.4 Validity of the study

This section evaluates the weaknesses and restriction of the study in terms of validity and reliability. First, the overall validity of this study, the level of accuracy of the inferences made by this study, is determined by discussing the threats to internal, construct and external validity [56], [66]. Lastly, the reliability of the study is assessed by analysing its repeatability and consistency.

5.4.1 Internal validity

Internal validity concerns the correctness of the cause and effect relationship from the inferences made in the study [56]. Particularly, internal validity refers to the data analysis phase. However, internal validity only applies to explanatory studies, unlike this one [66].

Nevertheless, it is still interesting to discuss the actions taken to enhance internal validity. First, the use of within-case analysis and cross-case comparison in the data analysis phase. Second, assurance of the internal coherence of the findings by checking the results with patterns established in previous studies. Third, the use of a case study database with the transcripts of the interviews. [66]

Further improvement of the internal validity could have been done by using multiple sources of data for triangulation [66].

5.4.2 Construct validity

Construct validity concerns the proper measure of the phenomena [66]. In other words, if the study measures what is intending to measure.

This study presents the following threats to construct validity. First, the approach we took for the interviews was to give freedom to the interviewees to explain their Lean Startup experience without framing the questions to individual practices. The reason for that was that, a priori, we were unsure of the knowledge level of the Lean Startup methodology by the the interviewees and the degree of Lean Startup practices application in each software company. However, that backfired because we were not able to get deeper feedback on specific practices. Second, the use of semi-structured interviews required a certain level of conversation between the interviewer and interviewee. This could have affected the neutrality of the research and lead to response bias. Finally, the first interview was not recorded. Even though, notes were taken, these did not collect the entirety of the interview. Thus, potential inaccuracies due to poor recall during data analysis threatened the construct validity.

On the other hand, a chain of evidence (research process) is provided to reconstruct the study from the research questions to the final conclusions [66].

Similar to the previous section, further improvement of the construct validity could have been done by using multiple sources of data for triangulation [66].

5.4.3 External validity

External validity of case studies concerns with the analytical generalization of the findings to theoretical propositions [56, 66].

The only identified threat to external validity is the slightly low number of cases. The difficulty to find software companies matching the required characteristics to study the phenomenon caused this threat.

On the other hand, several actions were taken to enhance external validity. First, the role of literature review was essential to construct a preliminary theory in the form of recommendations and final conclusions. Furthermore, comparing the results with literature review helped generalize within the scope of the research [66]. Finally, conducting multiple case studies was preferred over single-case study as the former offers robust analytical conclusions and that increases the external validity.

Therefore the core findings should be applicable to similar research problems outside of the empirical context of this study.

5.4.4 Reliability

The reliability of the results concerns with the repeatability of the operations of the case study [66]. To address this concern, the data has been consistently documented and presented in this thesis to form a chain-of-evidence from the analysis of the results through to the conclusions.

Chapter 6

Conclusions

This study was set out to explore the Lean Startup methodology application impact within established software companies that engage in exploration activities. For this purpose, this thesis focused on identifying how to apply Lean Startup practices in software companies. The Build-Measure-Learn process, hypothesizing (GOOB), testing (MVP) and measuring (Innovation accounting) practices were examined to determine their application positive and negative effects. Furthermore, this research provides a set of recommendations to successfully apply the Lean Startup methodology in software companies that aim to create new businesses. This research was conducted as a qualitative study using open-ended and semi-structured individual interviews from three Finnish B2C, B2B and consulting software companies.

In the literature we saw that Lean Startup has a big set of practices to steer and accelerate the product development process to build successful businesses. In this study, we only covered a few practices, and even with this small set the results clearly indicate that applying them is challenging too (the amount of identified challenges double the identified benefits).

The results indicate that the Lean Startup methodology is not a straight forward methodology and faces some initial resistance. Particularly, a resistance to change towards a more innovative company culture. In the beginning of its application, it is not that easy to understand what the Lean Startup practices are meant for. The employees do not have much knowledge of the methodology practices. It seems that the Lean Startup methodology requires time, training and effort to learn its practices and to change the mindset towards a more innovative culture from employees and customers. And the lack of proper communication of the Lean Startup benefits (fast learning-driven approach to create new businesses) causes rejection from external teams. Nevertheless, the results also reveal that the top management commitment to communicate and demonstrate early on what the Lean Startup is and how it can help software companies and customers has a

positive impact on the employees and customers. This will help them understand and accept more readily the methodology and the company culture mindset will shift towards a more innovative culture.

Therefore, the main conclusion of this study matches with the following empirical recommendation. To successfully apply the Lean Startup methodology in software companies there should be a stronger top management leadership and commitment in communicating and demonstrating very early on the benefits of the Lean Startup and how the methodology will affect the current company practices. Doing so will help customers and employees understand, learn and adopt the Lean Startup methodology while embracing a more innovative culture.

Another conclusion can be derived from the results obtained in this study. The empirical results confirmed one of the main advantages of the Lean Startup, that it provides a fast learning-driven product development process. Particularly, the application of Lean Startup adds qualitative and quantitative customer validation to the product development process which improves the process speed and accuracy and allows to reach product/market fits faster by using data-driven decision-making and learning about the customer behavior. However the results also show that there are many challenges that actually decrease the product development speed. From the software company perspective, the innovation team requires to work together in the same location to be able to operate fast and in agile manner. From the customer perspective, the results seem to indicate that, in a consulting context, customers determine to which extend software companies can actually use the Lean Startup practices and how and at which speed product development should happen. Another remarkable finding is that the volume of respondents can have a negative impact on the product development process speed. Low number of respondents lower the reliability of the collected feedback, thus making it necessary to wait until the amount of feedback is enough for proceeding to the next phase. In contrast, high amount of feedback might cause learning bottleneck slowing down the process speed too. In conclusion, to apply the Lean Startup practices and make full use of the fast learning-driven product development process, it would be advisable to define the way of working on a team level and clarify the methodology benefits to the customers so that they do not obstruct the potential of its practices. In addition, it seems necessary to control or regulate the volume of feedback to adjust the speed to its optimal level. The empirical study shows a recommendation where a coach role is advisable to support, guide and develop the process in a software company. Therefore, the coach could add in its responsibilities the guidance and control of the volume of feedback to support the product development process.

This thesis contributes to a better understanding of the field of corporate entrepreneurship theory and highlights the impact of Lean Startup methodology

in developing successful products and services in the IT industry. Lean Startup methodology was initially intended to support the continuous innovation of startups to create successful businesses. While the application of Lean Startup practices require software companies to have certain organizational characteristics, the results from this study support the hypothesis that the application of Lean Startup in established software companies is viable and can contribute to balance their exploration and innovation activities to create more desirable products and sustainable businesses. In this thesis, explicit means have been provided to improve the applicability of the Lean Startup methodology in software companies that aim to create new businesses. This study serves as a starting point for further research in this or other related areas, and it also paves the way towards more user-centered product development processes in the context of established companies.

The scope of this study (limited to the IT industry) invites to extend the research on established companies in other industries. Furthermore, new studies could address the excluded Lean Startup practices from this thesis. In addition, the scope did not allow for other research methods that would have probably shown stronger results. For instance, the use of Inside Action Research could study the implications of Lean Startup methodology applied to existing product development processes. There is need for more case studies to allow further assessment of each particular identified dimension and each business type (B2C, B2B and consulting context). Finally, the impact the application of Lean Startup methodology has on the corporate social responsibility of an organization is another neglected area in the research community. Therefore, it would be interesting to identify the benefits, challenges and recommendations to apply Lean Startup practices according to the values of the organization.

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Appendix A

Interview template

A.1 Interview template

Introduction - 5 minutes

Goal of the interview

Hi INTERVIEWEE, thank you for letting us spend some time with you to listen and learn from your own experience regarding the use of Lean Startup in COMPANY.
As I briefly mentioned to you earlier in the email, we asked for this interview because it would be an excellent contribution to the research of my Master's Thesis topic, which is to analyse the implementation of the Lean Startup in an established company.

How the answers will be used

Making use of this collaboration opportunity, we would be really glad that you could share your experience and use the results of the interview analysis as part of my thesis.

Confidentiality

When it comes to confidentiality, you can decide whether you want your name to be mentioned or not when the results are published. In order to ensure that the results do not contain any confidential information, if you wish to, I can send you the results of the analysis when they are ready.

Recording

If it would be alright for you, we would like to record the conversation for the purpose of having a backup material, as it can be a bit challenging to write all the answers during the interview. By no means, this conversation will be used in any other way than as backup to complete the analysis of the interview results.

Interview structure

As agreed earlier with you, the interview will be around 2 hours. The structure of the interview is as follows:

1. First, we will start with a couple of background questions about you,
2. And then, we would like to hear your experience of what was done on a general level. For that, we have about 10 questions to guide the conversation.
3. After that, we would like to continue with more detailed questions about your experience.
4. At the end, we will have summary questions and I will explain the next steps I am going to take with the results.

Background - 2 minutes

How long have you worked in COMPANY?
What kind of roles have you had over the years?

High level questions - 35 minutes

How did the development of products or services start?

Team

Who was involved in the team?
What roles did the team members had in the team?

Process

How did your team work together?
What phases did the products or services go through?

Collaboration with customers and users (Customer Development)

How many users are using the product at the moment?
What was the role of the customers?
What kind of collaboration did you have with customers?
How did you collect the data AND feedback from real customers?

Vision, Planning, Strategy

What approach did you use to define the Vision?
What approach did you use to plan the strategy?

Product

What tools did you use for product prioritization process?

Detailed questions - 1h

Team

At which point of the process do you need to set up a team?
How did you choose the members of the team?
What was difficult in organising the team?
What did you do to keep the team independent?

Process

What steps or activities did you follow in each phase?
From the previous activities would you highlight some with special relevance? Which ones and why?

Vision, Planning, Strategy

How did you transform the strategy into the first version of the product (MVP - Minimum Viable Product)?
How did you continue after that?

Hypotheses, Learning, Experiments

How did you know what you needed to ask from customers?
How did you validate these questions?
When did you know it was the time to get out of the building (GOOB)?
How did you define the learning milestones?

How did you hold the team accountable to learning milestones?
How did you document your questions and learnings over time?
How did you translate the learning to be validated into a feature, product?
How did you prepare the experiments? How did you implement A/B-tests?
How did you know how long it needs to be?
How did you test many experiments at the same time?

Measure

How did you measure the progress you were making?
What tools did you use to keep track/visualize of the measurements? (Google Analytics, KISS metrics..?)
How did you integrate the measurement into the product?
What kind of measurement analysis did you do?

Cohort analysis (might skip if not familiar)

Could you explain how did you do cohort analysis?
What cohort-based metrics did you use?
How did you build a cohort-based report?
How did you share these reports in the company?
What was important to check in the report?
What did you need to compare?

Product prioritization process

How did you prioritize the next features to do?

Product releases

What decided the length of the product releases?

Pivot

How did you know when it was the time to pivot (not doing it too early)?
How did you know which direction you needed to pivot?

Infrastructure

What was required before starting the process in terms of infrastructure/tools?
How long did it take to set it up?

Summary questions - 15 minutes

What were the most common pitfalls you encountered?
What would you have done differently?
What are the key learnings you would recommend for another company that starts to apply LS?
Is there something you would like to add that we haven't covered yet?

What's next - 5 minutes

Thank you for your honest and valuable feedback. How we are going to proceed with this is that I am going to analyse the results of this interview and use it to elaborate a collection of steps to implement the LS process, together with other sources (other interviews or literature review).

Additional questions

Company

How did you know the amount of budget needed?
What was needed to create the "island of freedom"?
What top managers sponsorship means?
Why was it important not to outsource key activities?
How did you make use of company's benefits?

Evangelizing the new process

When talking about Lean Startup and startup, how did you refer to what you are doing?
How did you explain concepts like validated learning, innovation accounting,..?
How did you communicate internally what, how and why you are doing this?

Appendix B

Detailed Interviews

B.1 Detailed interview - Company A

Background

The INTERVIEWEE is the Head of Quality and Environment at COMPANY A.

Initiating the process

The process starts by figuring out the value and what products and services could be built. For that, workshops are organised to try to identify the value propositions and put them in the Business Model Canvas (takes 2h). After that, COMPANY A thinks of alternative BMCs and iterate over the value propositions and BMCs again. Other things to consider when doing the workshops is to define the Customer journey to evaluate the different dimensions of the value for the services, and also, have a go-to-market strategy.

Teams

The teams are formed with 3-4 team members. Not much development is involved at this phase, because at the early phase it is more about defining the context, finding the value propositions. After that, it continues by defining a concept with the customer and setting up a collaboration team. The team is set up so that there is a customer interface, only having a product owner is not going to work. It is also important to have the role of the coach, that acts as support, or observation that helps in learning how to create and support the model, share it and develop it. It is also important to gather people who understand the culture, the philosophy. Defining the MVP can be difficult due to conflict of interests between developers and customers.

Product development

The product development and releases depends on each case (for example, you can have bi-weekly releases or 5 releases in a week). The product development is done mainly for products, as the value creation for services goes entirely to the customer so it is a bit more challenging to figure out what business model would work.

Tools

JIRA, User stories and EPIC (user stories and criteria definition). Also SCRUM and Kanban depending on the team.

Continuous deployment infrastructure

In terms of infrastructure, INTERVIEWEE does not see continuous deployment as a must to start.

Feedback management

During one feedback loop it can be that there are 5 releases/week. The key issue is how to get the feedback. Being in B2B, it is important to understand the feedback, how customer is involved, and sometimes it is necessary to tailor the "process" to the customer. Also, having a short cycle (also having a small team) can mean that you don't get so much feedback. The challenge then is that, in order to increase speed, the lack of feedback or low amount of feedback does not contribute to the speed.

Also, if you have too fast pace, it can pose a challenge in testing and getting feedback creating a bottleneck in the value acquisition level, not technical testing but "in-person" testing (getting feedback).

Sponsorship

In COMPANY A the top management is involved. COMPANY A has a strong message in their business segments where it explains the way of working. It shows that the company adopted these practices fully. They started with Agile in 2007 in the wireless business segment. In 2011-12 there has also been a good shift in the culture, but still lots of things to do.

Evangelising the process

Demonstrating the value of the model is something that must be done from the beginning and the company is beyond that. Also, customers understand this

approach very well. It is a model not just used in development but in all levels in the segment (involve all functions).

B.2 Detailed interview - Company B

Background

The INTERVIEWEE, at the time of the interview, hold a Director position in COMPANY B. His education background is in Mathematics and Computer Science. Previously in his career he was a Software Developer (in the 90s) and had also Sales role (in a startup prior to COMPANY B). He has been in COMPANY B since 2006 holding mainly Product management roles until his current Director position. His main activities during these years have been researching new concepts, businesses and developing strategies.

COMPANY B motivations to develop a B2C PRODUCT using Lean Startup

Expand company's portfolio

The Chief Strategy Officer is responsible for screening the market, identifying opportunities and selecting a few of them. During the course of researching various possibilities to expand the company's portfolio and to develop their strategy, COMPANY B identified a couple of areas that seemed promising. E.g. Focus areas: Privacy (external changes: Snowden).

Investments in new initiatives

The top management decided that COMPANY B should do more investments on selected new initiatives. Instead of focusing on developing too many little things (>10), the approach would be to focus on 2, 3, maybe 4 big initiatives and using senior leaders to lead them.

Need for speed

COMPANY B wanted to gain more speed and be able to go from idea to release as fast as possible.

Team evolution

The team increased gradually over time, starting from 4 members to 14 in 1 year.

The starting team, in May/June, consisted of:

- Chief Strategy Officer (CSO) as sponsor
- INTERVIEWEE Senior Product Management - full-time
- Senior Product Management - part-time
- 2 Designers (graphic and interaction) - not-full time
- 2 Senior Developers - full-time

Later on, more developers were added in the team.

Team skills

It is crucial to have the key skills, and people who are careful to deliver at any given time.

- Market skills: Understanding the market and domain (S. Prod Mgrs)
- Deep technical skills: understanding technical problems and challenges and being able to solve technical unknowns through hacking/prototyping (S. Developers)
- Design: Interaction design, graphical design, consumer workshops (overseas) (Designers)

Team resourcing: Outsourcing

- Design outsourcing not recommended: slowness, unpractical, confusion. Designers were sub-contracted very early on, starting from June and before adding the developers in the team. Designers worked from their premises and had meetings with COMPANY B twice a week. "This was a mistake because it caused slowness, it was not very practical and it created confusion." In the case of the developed PRODUCT, being a consumer product, internal resourcing would have been preferred, and designers would have required to be full-time employed in the building. "Designers should have worked together on premises from the beginning, being closer to the team. Not doing that we lost time. Also, internal resources would have been preferred, but the most important aspect was that the team should work together in the same location."
- Technical outsourcing is an option: isolated parts. In August, COMPANY B externalized the development of isolated parts of the product.

Team resourcing: Insourcing

In October, COMPANY B used the opportunity of structuring the company to shift resources from different focus areas to the team. Beware of the learning curve, especially for developers. It takes time to learn the way of working.

Team resourcing: Sponsorship pressure

Support from top management can become a heavy pressure in terms of "take more people and take more money", which was offered many times because they wanted to see this happening. Less is more. Small teams will be faster if you happen to have the right people. (more agile, no overhead)

Team resourcing: Team Culture management

Since the team has an internal culture, you want to preserve that, and not take too many people at a time that could cause unavoidable "fireworks", meaning clash of strong personalities that could damage the culture. The guys worked together in the past and also with INTERVIEWEE, so they were trusted and well-known.

Team resourcing: Budget needed estimation difficult to do

The estimation of the budget needed was made as a guess as it was difficult to foresee how much would be needed. Also, small budget from a previous project was used from the cost center.

Process phases

The process was split, from the beginning, in 2 levels to clarify the business and technical uncertainties until the 1st working prototype, where the process was merged back. The product definition level was meant to solve all the business uncertainties by validating the value propositions and list of features initially defined. The technical level was meant to solve all the technical uncertainties by defining, building and testing the technical foundation that would be needed eventually. Splitting the process was done to prevent delaying the project for 2,3 months that would have required to validate all the technical unknowns, and, also, to build a technology foundation COMPANY B did not have in place.

Product Definition level

The following is the order of steps COMPANY B followed until building the working prototype on a product definition level.

- Research and screen the market (without customers)
- Define Vision: Defining a rough idea by thinking what could be build and what could work based on the previous market research. Also, give rough cost estimates. In here, Business Model Canvas was used as a tool, but it could be any tool you want to use and you are familiar with. The point is to formalize and document your thinking to transform the vision into a product definition.
- Build prototype: Turn the idea into paper prototype/list of features (PDF or Powerpoint prototypes)
- Customer validation: Consisted on going to customers and doing market research with customers through dialog, talking to customers. This was the 1st focus group and consisted on interviews, making notes and videotaping.
- Re-defined/re-scope the vision and iterate
- Build prototype: Made changes
- Customer validation: The second time going to customers was quicker and served to confirm the re-defined vision. It was a 2nd focus group conducted also with interview format.

During the product definition level COMPANY B found very quickly a product-market fit (2 iterations), by repeating many of the questions to verify the value propositions. After redefining the vision from the 1st focus groups feedback, the value propositions did not change, however, features did change. Value propositions could reuse the same technology features to do many things, and it is not only about how they are implemented but also, how they are designed, and how they are visible in the product, and also, how they are marketed (what do we say within the product and externally. E.g. 1st screen in AppStore)

Technical level

COMPANY B knew that some technical foundation would be needed and that required to validate the technical unknowns. As soon as technical people was available, they started building a Proof of Concept, followed by internal prototyping and internal user testing with real people (in August). All this was done in parallel with the value propositions validation done in the product definition level. The internal prototyping already included some analytics, and, from here on, analytics results were also used as a form to collect feedback from customers.

Customer validation: Focus group studies

As soon as the "alpha" working prototype (MVP/product definition) was ready, COMPANY B used external customers to validate and verify again the value propositions with a real product. This customer validation was conducted with 3 focus groups (different people in each), although in a different format. COMPANY B invited 4 groups of 8 people each in the building and did observation and usability workshop and asked them to keep narrative diaries and return after some time of using the product. The narrative diaries consisted of recording during 1 or 2 days all of their actions: how they see, feel, think about the product, any interactions or situations that brought many things COMPANY B did not think about earlier. During that time, the customers would also receive sms suggesting different tasks. After the diary was completed, the customers returned and had another focus group discussion. Note that, here COMPANY B had qualitative and quantitative feedback based on product usage from the analytics.

Customer validation: Split testing and survey

After that, in November, there was a closed Beta version in Google Play app market and hundreds of customers were invited to test the product. The feedback was collected in 2 ways: indirect feedback via split testing and surveys. The indirect feedback via split testing was done by running a marketing campaign with Google Ads and Facebook and setting up 3 different landing pages to see which one converted best (A/B, split, multiple testing). After this, everyone who used the Beta received a survey request from which COMPANY B could get qualitative feedback. COMPANY B has a big beta community and they know everything about them (devices, age, ..), however they do not represent the general audience. This is why, the beta customer validation included both groups, to learn from both, knowing that the COMPANY B beta community would give biased results.

Customer validation: Knowing what you need to ask from customers

In order to figure out the questions to ask the team used brainstorming to gather the views from different people and used the big unknowns as research level questions, to break them down into smaller specific questions. To do that COMPANY B used internal and external competences, as the company's background is in consumer research. Also, from the surveys and focus groups they could learn what to ask.

Customer validation: Learning documentation

To document the learnings different formats have been used: PDF, powerpoints,.. These were all stored in a shared drive. Also, there was a wiki with a more condensed information. However, the powerpoint was the document of choice. "I wished we would have kept track of all our learnings".

Product Development: Prioritization

Feature prioritization was based on feedback from the customers, we started to use Powerpoint and then switched to Atlassian Confluence and now with more developers we use Jira. It evolved from very simple to use a company tool. We used sort of a Kanban but it was not pure canonical. It was very relaxed compared to company level. The transition is to go from waterfall > SCRUM > Kanban.

Product Development:Length of product release

Not decided anything, just release.

Product Development:Pivot

Feedback was strong at some point that we felt that we needed to change a little bit.

Product Development:Infrastructure

Nothing required, we had existing workstations. Developers required some cloud for development and deployment. (Amazon was quick). The production quality was relatively easy. Couple of virtual machines.

Measurement

Quantitative research

In order to know what is statistically relevant it is important to have a big number of respondents. Analytics should be placed in the frontend and backend.

Measuring the progress

Once a month the team would review and plan the roadmap (timeline with goals). During the process the goals were changed over time, switching them back and forth. It could be considered backtracking planning as we split the MVP to smaller MVPs. Decisions were based on gut-feeling. We were very goal driven, we wanted

to make it happen and we would ask ourselves if we had enough learning and if we could build this now? And, if we build it, let's build a meaningful beta. There was no formal excel, it was all constant brainstorming.

Visualize the metrics

The metrics were written in excel first, and later we used Omniture.

Measurements to analyse

To know the measurements that should be analysed we started by defining metrics for the questions from the unknowns. In the end we would have 100s of variables, but we put some together to make some sense of it.

Cohort reports

We had good enough cohort analysis. We used it to mostly to understand the conversion of each page and what impact the changes had.

Metrics information sharing

Sharing the metrics is something that we did not do actively. If we were to share some we would prepare a Powerpoint slide deck.

Format of the report

The format of the report was based on the AARRR model.

Process communication

Talking about LS

We explained what we were doing but we did not do it well enough, thus, we suffered from that. Some reactions were in the line of "We are not a startup". Some associate it with kids having fun, and potential financial gains, risk and so on. For some means fun, for some means serious business. The following needs to be explained: the philosophy, the leadership thing, a way of working, highly iterative, lots of talking to customers. As it came as top-down, we had instructions to transform the company and develop something. We felt that we had the leadership, and we worked almost like a company. That worked but raised some concerns as some asked why we were doing everything by ourselves. The argument I used was that we are a startup.

Branding

Be clear with the expectations about branding, that is very important. Be also ready to change. This is an strategic decision that can influence the parent company. Logic of endorse branding: Pros: not to use so heavily the big company brand, it would be easier to make it faster, so that you don't have to follow brand guidelines, maybe also the reputation, we could try more things, we could do things more edgy and maybe hide parent brand totally. Arguments for using the company brand: leverage marketing, domain, reputation. We lose all that, and we don't want to build everything from ground up as it requires bigger investment. So, if the logic is eventually to merge the product... Due to feedback it evolved into more security, so close to our core, this would be a major investment, we don't want that with another brand.

Company transformation

Having a broad background and understanding a little bit of everything might help to implementing the Lean Startup. As a company we have approached this too much from product development, it just goes to how do we write code, but it feels disconnected if the rest of things are done in waterfall then we don't get the holistic LS. Changed this now as a company. Software development is the easy part of the transformation (to agile and lean).

Retrospective analysis

Common pitfalls

Internal design needed and evangelizing failed

What could have been done differently?

- Clarify the branding from the beginning.
- Invest more on having the skills rather than outsourcing them (relating to the design skills outsourcing)
- One more technical person on board earlier (by weeks).
- Process wise I would repeat the way of working together with customers. It worked well, very very well.
- Marketing test was good but we failed in mechanics (FB, Google)

- Leadership, communication, communicate more to bosses but also peers. Spend more of the time in explaining (not time in legacy things), because it is very important for the company, and not for the project.

B.3 Detailed interview - Company C

Background

INTERVIEWEE started working in COMPANY C in 2008 and has had different roles as a developer ranging from Software Developer, Team Leader, Scrum Master and DevOps consultant/specialist.

Interview starts

Quite many know Lean Startup but not strictly following, depends on project and who is team leader. It is quite often depends on customers. They are used to follow waterfall, pitching scrum or agile is really hard already, so get the customer to know LS is really hard. COMPANY C only work with customer projects. We don't directly talk about LS to our customers. Depends on the team leader on how to guide the customers to make the decisions. Suggesting to implement small part, see how it goes and check later.

Process

The project starts with verifying customers' assumptions as quickly as possible. This requires a change of mindset on how to think about implementing something new, verify it first. Implement the main thing as quickly as possible and create an MVP.

Strategic vs product level assumption

In some projects we are really close with people that make the decisions, and we can help them to make better decisions, in some projects we cannot do anything they are too far. We are tied to development and not business level at all.

Difficult to collaborate with customers

We are external company, we are not part of the company, it is hard to, and dont want to that we come to their business side. There is a gap, but it depends on the customers. Sometimes it feels that we are 1 big company.

Projects starts

COMPANY C does Business consultancy - Service Design. Our consultant has some ideas for the customer that maybe this is new thing for you, make the plan, and then customer maybe selects us to implement it, not always. Estimations done. Build a team for the project, find the persons for the project that we will need. Meeting with the customer, choosing technologies, where we are going to run the project, customer hardware, cloud, preparations for the project.

Team

Depends on project. COMPANY C side: developers, designers, UX guys, not maybe full-time, usually in the beginning we need more, later on little bit less. The team does not grow, but change, e.g. Brand new service: designers to do UX guidelines, 2 devs to set up environments, drop designers and fill it with developers. The team is usually less than 10.

Process

Schedule usually is set by the customer, but we try to keep it open. It should be MVP, see how it goes, change direction. Customers need big plans, money we are going to spend next 1 year, some even want to write it in the contract, this is what will be delivered in one year. And we try to keep it as open as possible to be able to change this in the future. We dont want to make really long contracts, we define short contracts. It is hard to teach the customer to understand how to buy software. There is still a lot of old thinking. Quite often is a Scrum project, we try to find the product owner from the customers, team leader, devs. User stories, writing tasks, sprints, it comes from there how we work together. Try to get all the people in the same room. We try to get the customers also in the room. Usually customer wants first in their premises and then we switch to our building, or 2 days there, 3 days here. No strict rule on who the team should do from our company point of view. Find the way how the team works better. Switch from Kanban and Scrum. We use JIRA.

Collaboration with end users

Our customers handles out this. So the feedback comes from our customers. From their feedback channel. Google Analytics, direct feedback how the end users are using the service. (for web projects). Surveys, metrics inside the application, something you can't measure through the browser. In some projects we have a marketing team who make targeted messages to end users. Customers and us have access to the analytics results. Customers, want to see the business metrics.

Our design/UX team want to know how the user behave and run A/B testing, Developers want different things. Everyone has the access to that information.

Measurements to be analysed

It depends if it is an E-commerce or a project where there is no money flow but rather we are interested in the usage. Customers define the metrics, although sometimes they do not realise they should be following them. Then, we suggest. Developers and operational people need to follow different things: CPU usage, that kind of metrics collections, getting feedback, graphs. The developers metrics collection is growing, to have tools to collect metrics from the application and get some feedback. to make more informed decisions.

Production prioritization process

Prioritization comes from the customer based on some business needs or trying to push the decision to us, but scrum master has to make attention that it is the customer/product owner role to do that. We should help to make a more informed decision, but they should make the decisions.

Product Length of releases

Sprint length, average is 2 weeks. In some projects we have 2 week sprints, so we release every week. I would like to see more often, continuous delivery or deployment. We have to sell these things to customers and takes time to make it possible. You need to set up all the automation testing/deployment tools, much better automated testing to be able to continuously deploy. Developers have to change how they think. Scrums make you think that I have 2 weeks. Change the mindset to it can be always shippable. Just one button, implement first, and last step, add the button to UI. Development team would be ready to go faster, and customer doesnt want, because they see it as a risk. If you deploy faster, there is much smaller risk, less changes in the deployment. It can also be that customers are used to work in cycles and they do not understand that it can go differently, why should we? In some projects we can work quite independently, and the team can decide how they work. And in others we are really close to the customers and in their environment, and we are not allow to do the release and the production team decides that is a once in a month. So, the biggest challenge is to get the to understand that there is a better way to do it.

Customer validation

Customer makes business assumptions, but designers make assumptions if the UI works or not, developers make assumptions (Technical). People dont realise they are making assumptions, these are the features what we do, this is the product, and they just implement it, but at any point they dont ask if are we doing what customers want. So, we dont validate the assumptions. Team leaders should help the customers to understand that the features should be measured to see if it is something people want and give the feedback to the customers. When making decisions we should also check if they were good or bad. In large companies, they have to decide and raise money for these features, so, when they get the money they have to build the features, regardless of it is useless or not. Because we have to show to stakeholders that we have implemented this. This mindset should change and spread to the whole chain.

Learnings tracking

Very hard to track the learning. And we dont communicate to the customers that by using this approach we should be able to learn more. Marketing team does UI A/B testing, like change image size and campaigns A/B testings but we don't use it to validate technical features. We need the customer to understand feature verification approach, we don't do it now.

Pivot

We don't pivot, because the customer expects the boat to go in the right direction from the beginning. Small changes but not big changes.

Infrastructure

List of things every project should have. At the start you dont need everything. You should also do minimum viable product with the infrastructure, so that you dont have much waste if after 1 week. In the beginning this: Version Control, CI server, Tests (unit tests, ..) as examples Set up everything you need for testing and deliver the HelloWorld. Configuration management tool: Puppet, Ansible.. Maven is built tool Analytics: quite often we add later, so it is quite new thing at the moment

Brand reputation

not branded with customer brand, create temporarily brand, and check this first, and then tell it's part of the customer. Verify in closed doors sometimes, but it

would go released fast if it was LS approach.

Company Culture

We are doing things from LS but we are not aware we are really doing it. Team leaders have read the book, and read some papers. No strict rule that you have to follow. It depends on project and how it evolves. In communication we use the term MVP, sometimes people use it even though they dont know what it means.

Pitfalls

- We dont acknowledge that we do LS
- Customer mindset and developers way of working
- Biggest thing as a team leader is to change customer's mindset. because you are not part of the company, you can drive them to do these things, at the end how they do things, you cannot change it.

What would have been done differently

- Small steps forward: Try to think all the time how we can verify the assumptions we make and go forward with that. Really agile way and in small steps. All the time I see steps big, of what we implement and decisions customers really make.
- Main thing the end users want, think easiest way to find out if that's the thing customers want, and how to measure it, implement it, measure, see results, and then next steps.
- Be really close to the people who makes the decisions, you have to make decisions every week. In real like, it's quite hard, the stakeholders, continous delivering, do I really have to every month makes decisions, it requires so much time for me! People who make decisions they make once in a year decisions, you have to be ready to make decisions every week, all the time. They don't want to be every week making those decisions.

Key learnings for other companies

Everyone has to change, embrace the change, also customer companies. It isnt enough if a single person knows about lean startup, not enough if development team of LS. Everyone needs to understand where are we going and what we are going to change. This is tricky.

Connection of DevOps and Lean Startup

Both there is Lean behind. Work really well together Automate different steps, easy and fast way, cycle times. Lean Startup needs that to do testing Feedback from the end users to get the answers, DevOps have this and LS need that too.

DevOps

Making developers and operational people work well together (sysadmins or whoever manages the environments) how to automate whole deployment, provisioning Also a bit about business people, people who make decisions. because it doesnt matter if you can deploy every 5 mins if business people make decisions every once in a year.

DevOps need continuous delivery and LS.

Continuous deployment (ready to deploy), that is the ultimate and ideal environment. It doesnt matter if you release every week, day, it doesnt give you anything if you dont use it. it needs LS thinking to gain the full power in DevOps. So, if it takes one month for you to deploy, why do you want a continous deployment system, you dont need it.

Appendix C

Overall impact tables

C.1 Lean Startup application positive effects

	Organizational
BML	**Innovation mindset**
	Employee motivation towards innovation
	Increase of team responsibility
	Increase innovation competency
	Break silos with cross-functional teams
	Customers and employees understand Lean Startup methodology value
Innovation accounting	Increase innovators accountability
	Higher credibility of collected data
	Common language between manager and innovator/entrepreneur
	Technical
MVP	**Prevent feature creep**
	Customer
BML	Increase customer understanding
	Collect direct feedback
	Demonstration of customer value adding/destroying activities
	Reduction of experimentation time to validate ideas
	Higher end-customer acceptance
	Established customer base on mass market launch
	Strategic advantage as a partner
...	

Table C.1: Lean Startup application positive effects (1/2)

...	
GOOB	Discover misguided plans
	Discern the right questions to ask
	Potential to improve the product
MVP	Establish a baseline customer behaviour
	Capture customers creativity and feedback in real time
	Real customers pool grow over time assuring product success
Innovation accounting	Expose concealed customer behaviour
	Cohort of customers available for qualitative research
	Metrics support the learning about customer behavior
	Increase accountability towards customer
	Product Development Process
BML	**Customer validation added to the process**
	Data-driven decisions
	Increase accuracy in product value
	Fear dissipation about product quality and acceptance and brand damage
	Waste mitigation saves time and money
	Shorter feedback cycle
	Faster product/market fit
	Split the process on business and technical level to save time
MVP	Faster, cheaper and more accurate experiments
	Seed to continuous improvement
Innovation accounting	Metrics improvements demonstrate validated learning
	Data-driven product development prioritization
	Easier to determine pivot timing
	Faster pivots

Table C.2: Lean Startup application positive effects (2/2)

C.2 Lean Startup application negative effects

	Organizational
BML	**Resistance to change the mindset**
	Top management overprotection towards the company
	Innovation scope limited to corporate strategy
	Top management lack of support towards the innovation team
	Lack of experimentation skills and LS practices knowledge
	Raises complaints from external teams for not following company procedures
	Lean Startup understanding rigidness
	Difficult to make budget estimations
	Design outsourcing creates slowness, confusion and is not practical
GOOB	Risk of engineers disclosing classified information
	Brand/relation risk if customer interaction company rules not followed
	Financial support needed
MVP	Patent protection might be compromised
	Fear about competitors about stealing the idea
	PR Branding damage risks
	Negative impact on teams morale
	Temptation to overbuild and over promise
	Commitment to iteration reluctance
Innovation accounting	Duplication of efforts for end-user acceptance and top management funding
	Technical
BML	Experimentation scope reduced with lack of user interfaces
	Experimentation infrastructure implementation on top of a mature project
	Difficult identification of value-adding measurable metrics
MVP	Technical debt
...	

Table C.3: Lean Startup application negative effects (1/2)

...	
	Customer
BML	**Customers can be doorkeepers**
	Acceptance-tested software by customers before production release
	Fear of overpromising to end-customers
	Developed features come as requirements from customers
	End-users as customers' customers complicates feedback collection
	Legal agreements for usage data and user feedback collection
	Lead customer pro-activity required to develop the experimentation process
	Customers push product feature prioritization to the consulting company because they are used to make decisions yearly
	Difficult selling short contracts open to future changes
GOOB	Interaction only happens with sales, not with development team
MVP	In B2B, indirect access to end-users complicates collecting feedback
	Adding customer in the team complicates the MVP definition
	MVP practice is misunderstood
	Customers do not need and avoid validating hypotheses
Innovation accounting	***Biased results if not validated with beta community and* "general audience" customers**
	Product Development Process
BML	Unclear hypotheses and results expectations might hinder the learning ability
	Company bureaucracy slows down the development speed
	Reduced experiments reliability due to low end-user volume
	In B2B, it is necessary to tailor the process to the customer
	In B2B, fast feedback cycle creates learning bottleneck
GOOB	Temptation to start testing too early
	Analysis paralysis
I.accounting	**Duplication of metrics increase complexity, costs and time consumption**

Table C.4: Lean Startup application negative effects (2/2)